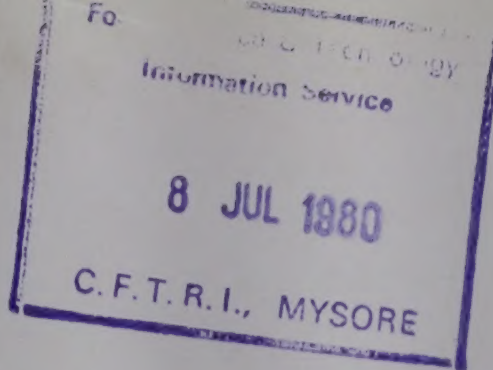




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Volume VIII

Number 1

January 1980

Editor:

Dr J.B. Subramaniam

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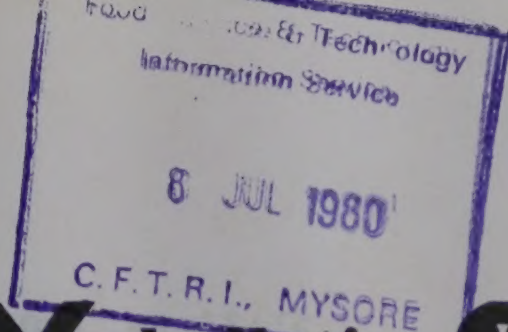
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Editor:

Dr. J.B. Subramaniam

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Deshmukh SS
Sachan MKS
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Editor:

Dr. J.B. Subramaniam

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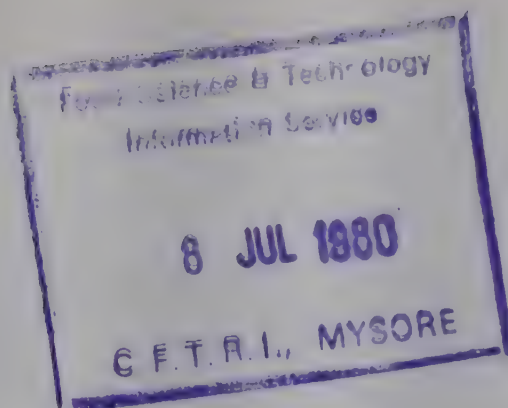
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Dr J.B. Subramaniam

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Dr. J.B. Subramaniam

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SENDOK bulletin **I**

Part I: Industry and Technology

Volume VIII

No. 11

November 1980

Editor

INSIDE

Dr. JB Subramaniam

Associates

Datta Reddy KS

Seetharam MV

Senguttuvan S

Spurgen C

Subba Rao M

Sudhakara Rao BS

Vishwas Rao V

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Processes

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NEW PRODUCTS AND PROCESSES

CHEMICAL INDUSTRIES

Benzylamine

The Central Electrochemical Research Institute (CECRI), Karaikudi, has developed a process for the production of benzylamine.

Benzylamine is a drug intermediate used for the preparation of active organic principles. It is also employed as an efficient corrosion inhibitor and a brightener in plating baths. Benzylamine is not known to be produced in the country and hence its use is limited.

The CECRI process consists in the reduction of benzonitrile in a supporting electrolyte using a stationery deposited nickel black-over-graphite cathode in a divided cell. At the end of electrolysis, the catholyte is distilled to recover rectified spirit. After the removal of unreduced benzonitrile, the residue is neutralised to liberate benzylamine. The amine is purified by distillation.

The process has been studied in a 75 A cell capable of producing 220 g. of benzylamine per batch of 8 hr.

The main raw materials required in the process are: benzonitrile, sulphuric acid, sodium hydroxide, rectified spirit, nickel sulphate and ammonium sulphate. All these are available in

the country.

The plant and machinery required are: rectifier, electrolytic cell with cathode and anode, refrigeration unit, neutralization tank, steam boiler, distillation column and storage tanks.

The capacity of an economically viable unit for producing benzylamine is 30 tonnes per annum. It is estimated that the total investment required to put up such a plant will be Rs 16.60 lakh. The breakup of investment is as: fixed capital on land and building Rs 1,20,000; fixed capital on plant, Rs 5,13,000, working capital, Rs 8,99,700; preliminary and preoperative expenses, Rs 1,00,000; and know-how fee Rs 25,000. The cost of production has been worked out to be Rs 130/kg.

Hyoscyamine and Atropine from Egyptian Henbane

The Phytochemistry Division of the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow has developed a process for the production of hyoscyamine sulphate and atropine sulphate from Egyptian Henbane (*Hyoscyamus muticus* L.). The process, which was initially developed on bench-scale with 2-kg. lot of the drug, has been scaled up to 40 kg. batch, in their drug factory at Jammu. The atropine sulphate, produced by the Institute has been evaluated by leading pharmaceutical houses, who found it comparable to the atropine sulphate imported from abroad.

In this connection, it is significant to point out that all our requirement of atropine sulphate is imported from abroad, as we do not have the proper raw material for production of this chemical from natural sources. Uptill now, the only available sources of hyoscyamine sulphate and atropine sulphate are *Datura Stramonium* L. (0.3-4% total alkaloids) and *phioschlaina praealta*

Miers (0.6-0.7% total alkaloids). Atropine sulphate, produced from these raw materials, would be too costly as compared to the international market. As such, no attempt had been made to produce this important drug in the country. Egyptian Henbane, which has been introduced by the Institute recently, has 1.4-1.5% total alkaloids, of which more than 90% is hyoscyamine, which can be easily converted into both hyoscyamine sulphate and atropine sulphate at a cost comparable to the imported price. The Institute produced more than 200 kg. of this drug during 1979, which has been processed in its factory at Jammu. Large-scale trials have been laid out for production of the drug at its farms in Lucknow, Pantnagar and Jammu so as to start commercial production of the drug. The process can also be passed on to those who are ready to produce their own raw materials in any part of the north Indian plains.

ELECTRONICS AND ELECTRICAL INDUSTRIES

Digital Densitometer

The transmission type digital densitometer DM 5787 is a versatile instrument for a quick and accurate measurement of the optical density of black and white films in such areas as photographic material. The relationship is very difficult to define in such areas as photography, microfilm, graphic arts, medical and industrial X-rays, etc. The prototype of this unit was developed at the Bhabha Atomic Research Centre, Trombay, and the production was entrusted to the State-owned Electronics Corporation of India Ltd.

An important application of the densitometer is in the field of sensitometry, where it can establish accurately the relation between exposure and density of any given photographic material.

The relationship is very difficult to define in words such as low contrast, 'high speed' poor black' etc. The purpose of densitometry is to derive accurate numerical values for the exposure density relation of a material so as to eliminate guesswork. The results are in units which can be universally applied and compared.

Optical density relates to the absorbing power of a photographic film. Exposure followed by processing produces blackening on a film. It can be quantitatively measured as density 'd' and is expressed as the negative logarithm of transmission "T".

The densitometer consists of a light source and a light detector. Any film introduced in between them reduces the amount of light falling on the detector. The larger the reduction the greater the density. This reduction is calibrated in terms of density. For example, if the transmission of film is 10 per cent, the density value is 1.

A straight filament tungsten lamp, powered by a DC regulated power supply forms the light source. Light from this source passes through an 'infrared heat absorption filter' and is collimated and focussed at the aperture by a combination of lenses. This beam passes via the film to the light detector through a diffuser. The light detector is a multidynode high sensitivity photomultiplier that detects the low light levels through high density films.

In photography the densitometer is used in the evaluation of control strips for film manufacturing and process chemistry monitoring. This is required to control the homogeneity or uniformity of coating on the film. The densitometer is also used to measure and control film background density of microfilms. From the background density the contrast that can be obtained is known. It

also finds application in 'masking' and 'dye transfer techniques'

In graphic arts the densitometer is used for measuring tonal and half-tonal values for positives and negatives and to determine the printing requirements.

In the non-destructive technique of finding structural damages by X-ray photography, the densitometer is used as a lie detector and a quality control tool for assessment of defects by proper selection of background density. The densitometer is useful for measuring the radiation dose received by personnel working in radioactive environments.

Specifications - density range: 0 to 4.00 in a single range: least measurable density: 0.01; reproducibility: plus or minus 0.02 or 1 per cent whichever is higher; output indicator; 3 digit LED display; response time; Instantaneous.

Dual Frequency Electromagnetic Unit (ground)

The instrument finds use in mineral prospecting and detection of underground ore bodies like metallic sulphides, lying under a cover of poorly conducting overburden.

The present demand which is about 6 units per year is met partly through imports from USA and UK and partly through the supply from the National Geophysical Research Institute (NGRI) Hyderabad. The demand is expected to be about 100 units in the next 10 years.

The instrument, which is based on the principle of electromagnetic induction, is a null type device, with a piezo-electric headphone as the null detector. It consists of a transmitting coil and receiving coil, coupled to each other via the intervening

ground. The distortion of the electromagnetic field in the receiver location is measured by taking reference from the transmitter.

The technique of manufacture consists of the following main steps: (i) procuring electronic hardware parts, including imported -metal strips; (ii) winding the receiver, transmitting and reference coils, etc. (iii) fabricating and assembling headphones; (iv) fabricating the dinometer, transmitter stands and electronic assemblies, (v) calibrating the potentiometer (vi) assembling the equipment, and (vii) field testing and calibration.

Main components required are electronic hardware like transistors, diodes, integrated circuits, capacitors, chokes, etc. μ -metal rods; bakelite/glass/epoxy copper clad-boards; μ -metal rods are to be imported.

The main equipment needed are: Digital multimeter, frequency counter, oscillator/function generator, alternator, oscilloscope, LCR meter, bench drill, grinder, hand tools, etc.

Predesign cost data (6 units per year)

	Rs.
Land and building	0.9 lakh
Equipment and machinery	0.61 lakh
Working capital	0.18 lakh
Cost of production	10,820/unit

The instrument has been under production at the National Geophysical Research Institute, Hyderabad on batch scale and so far 8 pieces have been sold to actual users. The instrument is available for inspection at the laboratory. The laboratory also provides facilities for environmental and ruggedness testing on payment. The manufacture of this instrument can be taken up by a unit already

engaged in the manufacture of other geophysical instruments.

Electronic System Design Kit

The Centre for Electronics Design Technology at the Indian Institute of Science, Bangalore has developed an Electronic System Design Kit which is an improvement over the conventional design of electronic equipment and systems where the interconnections of the components made by soldering wire pieces were time-consuming and highly prone to malfunctioning. The development of highly complex circuitry has become simpler and faster now, thereby increasing the efficiency of the electronics designer in R & D laboratories and institutions.

The Design Kit consists of a control unit and a breadboard frame with sockets for different components and patchcords which are gold-plated for high reliability. The main unit of the kit has power supplies, clock generator, display and logic level switches, thus making the kit fully self-sufficient. The detachable breadboard can accommodate all the common electronic components and gives an unlimited flexibility in the applications of the kit in both analog and digital circuit designs.

Toroidal Coil Winding Machine

Toroidal coil winding machine is used for winding coils over toroidal core. Some of the applications of toroidal coils in electrical and electronic industries are in current transformers, differential transformers, sensing transformers, etc. Since the toroidal core is a continuous magnetic material, winding a coil over a toroidal core differs significantly from normal coil winding on E/I or U cores generally used for chokes and audio and power transformers.

The Central Electronics Engineering Research Institute, Pilani has developed knowhow for manufacturing a toroidal coil winding machine, with specifications: capacity of winding 12 ■ (bore 75 ■); No. of turns per minute 30 to 60; pitch adjustable 0 to 3 ■; turn counting meter Hick type; base area 60 cm x 60 cm; and weight about 40 kg. The design is patented and has been successfully tested.

Toroidal winding machines for special purposes are being imported, though indigenously made machines are available for general purposes. The performance of the new machine is similar to that of the imported machines but with less cost.

It is advisable that the existing machinery manufacturers take up this as an additional item to their production and thus reduce or eliminate the need for additional machinery. The equipment needed are lathe, milling machine, bench drill, bench grinder, power hacksaw, hand tools, measuring tools, etc. all indigenously available. The main raw materials required for production are mild steel, iron casting, brass bushing, gearing, FHP motor and counter, all indigenously available.

The investment needed for manufacturing 60 toroidal coil winding machines/year is estimated at Rs 1.65 lakhs (fixed capital Rs 0.85 lakhs, excluding land and building, working capital Rs 0.80 lakhs). Investment on machinery may be suitably modified after taking into account all the existing facilities available with the entrepreneur.

ENGINEERING INDUSTRIES

Automatic Pot Plant Waterer

If a plant is to grow, its roots must have access to both air and water (as well as nutrients). Sadly, more indoor plants die

from an excess of water than a lack of it, especially in winter. The over-zealous owner has drowned the roots, cutting off their supply of air.

The CSIRO Division of Environmental Mechanics, Australia has devised a simple unit to supply water to valuable pot plants so as to keep soil moisture at a predetermined level. The device was designed by Mr Keith Perroux for horticultural experiments, but it would seem to be very useful for home owners keen to keep their indoor plants flourishing. The Division would be happy to provide design information to any manufacturer willing to market the device.

The unit has no moving parts. A water jacket surrounds a porous pot in which the plant grows, the water jacket being fed from a sealed reservoir. Now the flow of water through the porous wall of the pot cannot proceed without creating a negative pressure ('suction') in the reservoir, since the reservoir is not open to the air. With no air entering, the water flow would soon be pulled up short.

Mr Perroux's idea is to let air enter the reservoir through a plug of porous sintered glass. Such capillaries are available commercially as 'filter sticks', with pore diameters ranging from 200 μ m to 2 mm. With this set-up, water level in the reservoir drops until the suction is sufficient to draw air through the capillaries in the filter. The smaller the pore size, the greater the pressure drop required.

Thus, the level of moisture in the soil is maintained within narrow limits by the particular pore size of the filter stick in use. The only other special requirement is that the pot in which the plant grows should let water pass through easily but prevent air from doing so, otherwise the air-controlling action of the

filter stick would be over-ridden. Common kaolin clay castings are satisfactory in this respect.

Mr Perroux has used his device in a number of experiments. Except for fluctuations in soil moisture due mainly to the effect of temperature changes on the pressure of air in the reservoir, the watering controller has kept the soil moisture level within reasonably close limits.

For more information: CSIRO Division of Environmental Mechanics, P.O. Box 821, Canberra City, A.C.T. 2601, Australia.

Automatic Wire Notching

Cutting of V-notches on a square steel wire of very large length (say 10-100 meters and above) at a given short pitch (say, at intervals of 2-4 ■ length of wire) can usually be performed on a special purpose wire-notching machine equipped with an automatic feeding arrangement to control the pitch and a form-punch reciprocating vertically at controlled speed. However, since such a special purpose wire-notching machine is quite costly, it is not economical for a general engineering jobbing workshop or a prototype production unit to purchase this machine, because their requirement of wire-notching, may not be much. To overcome this problem, an improved method of wire-notching has been developed at Armament Research & Development Establishment, Poona by using a specially designed circular cutter on a conventional milling machine.

In a mating pair of rack and work, if the worm is rotated on a stationary shaft, the rack will travel in a straight line. This travel of the rack on rotation of the worm is computed by the formula, $S = t.n.a.$, where 'a' is the number threads on the worm,

't' the pitch of the rack teeth, and 'n' the speed of the work in rpm.

Now, if the thread of the worm is interrupted or serrated cross-wise and relieved to provide cutting edges, then as the raw material for the rack is fed into the rotating work (with cutting edges) it will cut the rack and will also move it forward. This principle has been applied in the new method of cutting notches on wire.

The tooling required for the new method involves design of a circular worm-type cutter and a holding and guiding fixture for wire.

CIRCULAR CUTTER : A central hole is made on a high speed steel blank (150 ■ dia x 25 ■ width in this case) to suit the arbor of the milling machine to be used. External V-threads of required pitch (equal to that of the notch) are then cut on the full width of the blank on a lathe. Finally, a large number of flutes (say 100) are cut across the threads at an angle of 20° to the axis to turn the serrated threads into cutting edges.

HOLDING AND GUIDING FIXTURE : A simple fixture is made for holding and guiding the wire for feeding it to the cutter continuously.

The worm-type special cutter is mounted on the horizontal arbor of the milling machine. The machine is set preferably at a low rpm (30-100 rpm) and switched on. When the cutter starts rotating slowly about a horizontal axis, the wire is fed through the fixture in a straight line across the width of the cutter. The cutter cuts a number of notches, depending on the number of threads on the cutter, simultaneously dragging the wire. The

notches are cut at the same pitch as that of the initial threads on the cutter on the full length of the wire.

This new cutter can also be mounted on a fitting bench, and notches can be cut by rotating it by a handle.

Earth Auger

The Regional Research Laboratory, Bhubaneswar, has developed a design for earth auger which is very frequently required in agriculture in digging hole on earth surface for use in fencing, soil testing etc. It has got the following advantages over the conventional tools: - It drills almost the required diameter uniformly through the length of the hole. It removes the cut soil from the drilled hole. It cuts the roots, if any, at the hole surface. It does not disturb the natural strength of the soil beyond the hole dimension. The time and energy requirement in making a hole are much less. Small diameter and deep holes are very conveniently done, for soil testing at various depths. It can be manufactured at a very low cost. It is very light for transportation to field. It is very simple in design and hence there is no repair complication.

The earth auger developed by RRL consists of an augerbit and a handle to operate manually. The augerbit is made of a round steel bar, pointed at its one end and has a plurality of helical discontinuous steel cutters welded on it at equal interval.

M.S. pipe, carbon steel sheets, M.S. rods are the raw materials needed for the manufacture of earth auger.

The unit can be manufactured in any general fabrication workshop having the following equipment: Fly press, electric arc

welding machine, hand shearing machine, and small tools.

The total investment for setting up a plant capable of producing 50 units per day has been estimated at Rs 85,000/-, the capital on equipment being Rs 30,000. The cost of production comes to Rs 3/- per unit.

Filament Winding Machine

Fibreglass reinforced plastics are light-weight materials but they have very good mechanical and electrical properties. Also they have excellent resistance to corrosion by chemicals. Based on these special features, the FRP material is widely used for making components in the field of aeronautics, space, electrical, chemical and allied industries. The method for manufacturing these components usually involves a filament winding machine. The National Aeronautical Laboratory (NAL), Bangalore has developed the know-how for the manufacture of such winding machines, the design of which has been patented.

Filament winding is a process by which glass or metal in a continuous filament form and a compatible polymer are combined to make a reinforced plastics structure. The presently developed winding machine carries out the winding operation in an efficient way. The main elements of the machine are: A mandrel drive system, a feeder drive system, and associated electrical circuits for starting and stopping the above drive systems.

There is also an electrical coupling for simultaneous stopping and starting of the two drive systems. The mandrel drive system has a three phase electric motor, a reduction gear box, a mandrel mount etc. for obtaining different mandrel speeds. The feed drive system consists of an electric motor, a lever-operated gear box,

a feeder carriage, a screw rod to facilitate feeder carriage reciprocation, motion limit switches, safety limits and roving delivery system.

Wetting system provides a regulated feed of resin on to the fibreglass roving during the winding process. Suitable squeeze rollers are used to secure uniform wetting and to control the resin content.

The assembly comprises a superstructure on which are mounted a fibreglass roving mount with a variable speed drive for adjusting the fibre tension, a resin wetting system including an excess resin remover, a precuring chamber, a tension adjusting pulley, a tension measuring device, a fume duct, a console for electrical circuitry etc.

The broad specifications of the filament winding machine are given below:-

Max. diameter	140 ■
Min. diameter	25 ■
Max. length	750 ■
Winding angle	30° Helix to 89° circumference
No. of mandrel speeds	8
Max. feeder speed	31 M/Min.
Min. feeder speed	0.47 M/Min.

NAL, Bangalore has fabricated a number of winding machines and have supplied them to different organisations. Their performance have been found to be excellent.

No market survey has been conducted, but due to the huge application potential of FRP in different industries like chemical electrical etc., the demand for this machine is expected to be

significantly high.

The main equipment required for the manufacture of these machines are gear head lathe, drilling machine, cutting machine, grinding machine, welding set etc. All are available indigenously.

The main raw materials/parts needed for manufacturing the winding machine are: reduction gear box, electric motor, gear lathe, contactors, push button switches and other hardware items.

The total fixed capital has been estimated at Rs 1.6 lakhs excluding the cost of land and building. The cost of production has been estimated at Rs 30,000/- per machine, while similar imported machine will cost about Rs 80,000/-

FOOD AND ALLIED INDUSTRIES

Extrusion Cooked Products

Extrusion cooking is the most economic known process for the production of dry, cooked products in large quantities. Added to the factor of economic operation, is the hygienic nature of the process and the versatility offered by way of the immense variety of raw materials and their combinations, as well as the flavouring techniques that can be utilized.

The operating capacity of the plant has been taken at an average value of 150 kg/hr. In specific products it would be possible to achieve higher output.

This is a continuous process plant and its annual output would be of 850 to 1,000 tonnes of finished product.

Virtually all types of cereals, pulses, oilseeds and other low moisture raw materials may be used. In some products,

pre-processed raw materials such as: starch, dehydrated vegetables, etc., can also be used. A wide range of flavours, colours and nutrient additives could be incorporated in the processing.

The following would be the machinery and equipment required in the process plant. In specific cases, some changes may be required in this list. In some cases the specific machine to be selected would depend on the product group to be processed: Hammer mill, Blender, Cooker Extruder, Conveyerised drier, and Packaging machinery. Auxiliary equipment would include materials handling equipment, weighing equipment and a testing laboratory. Services required would be a power supply of about 125 KW and about 2,000 litres/hr of water, mainly for cooling and for hygiene requirements.

The plant would require two semi-skilled operators per shift of operation, besides a foreman capable of setting the machine as electrical maintenance. All other shop labour could be unskilled. From 3 to 30 persons would be required, depending on the extent of automation used.

The actual floor area in the shop floor would be between 800 and 1,500 sq.ft depending on the type of construction. Additional provisions for storage and office space would depend on individual requirements. Normally about 5,000 sq.ft should be sufficient to cover all requirements.

Fixed capital is Rs 14 lakhs to Rs 16 lakhs, while working capital requirement could vary from Rs 7 lakhs to Rs 11 lakhs, depending on terms of operation, type of market, product, bank facilities, raw material availability and purchase policy, etc.

Further details may be obtained from Bangalore Tool Works Private Limited, 33, Queen's Road, Bangalore-560 051, Karnataka.

Small scale Fermentation of Cocoa

Cocoa beans after extraction from pods, must be subjected to fermentation, as a pre-requisite for development of the flavour and aroma characteristic of chocolate and other cocoa products. Present methods of fermentation require large quantities of cocoa beans: a minimum of 25-30 kg. is necessary for successful fermentation (10 to 15 pods may be required to obtain a kg. of wet beans).

The tray method followed in Kerala also requires about 40-50 kg. of wet beans at a time. This often poses problems to the majority of cocoa growers, especially in Kerala where the average size of holdings is well below one hectare. The number of pods harvested at a time is too few to go in for any of the traditional methods of fermentation.

Investigations carried out in the College of Horticulture, Kerala Agricultural University, at Vellamikkara have shown that as small a quantity as 1.5 kg. (from 15 to 20 pods) of cocoa beans can be fermented by either of two methods outlined below.

The process of fermentation or curing the beans consists of three steps - collection of beans, fermentation and drying.

Collection of beans: Ripe healthy pods harvested with a sharp knife should be used. Pods can be broken two days after harvesting for scooping out the beans. Clean beans thus collected should not be kept for more than 24 hours, nor should they be washed or dried.

Two methods of small-scale fermentation have been found successful.

Mini-basket method: Here a small closely woven bamboo basket with a diameter of 20 cm and a height of 20-25 cm which can hold

about 2 kg. of wet beans is used (Attempts with less than 2 kg. were unsuccessful probably due to the inability of the basket to retain the moderately high temperature required for proper fermentation). The basket is then lined with one or two layers of banana leaves, part of which projects above the brim. Freshly collected beans are filled in the basket giving a slight pressure by hand, and the top surface is covered with the banana leaves. A small weight is placed to hold the banana leaves in position. The basket is then placed over a brick or on a raised surface to facilitate drainage of the 'sweatings' from the beans for a day. On the second day, the basket is covered with a gunny sacking which is kept in position by a light weight, preferably of non-conducting material. The beans are taken out and mixed thoroughly and again kept covered with the banana leaves and gunny sacking on the third and fifth days after initial setting. On the seventh day the beans can be taken out for drying.

Mini Box Method : Here, instead of the basket a small box of size 20 x 10 x 10 cm., made of hard wood planks of 1¹/₂ cm. thick and top open, is used to ferment about 1.5 kg. of beans. All the sides of the box should be provided with one to three rows of holes of 0.5 cm dia. Nails used in the box should not come into contact with the fermenting beans. The process is the same as in the mini-basket method. The beans can be taken out for drying on the seventh day.

An index of satisfactory fermentation is the presence of a well marked peripheral brown ring of the cut surface of more than 50 per cent of the beans. The beans will be deeply straw coloured and appear to be slightly swollen due to the presence of a brownish liquid inside. In a typical fermenting mass, this stage is reached around the sixth day. Overfermentation by keeping for more

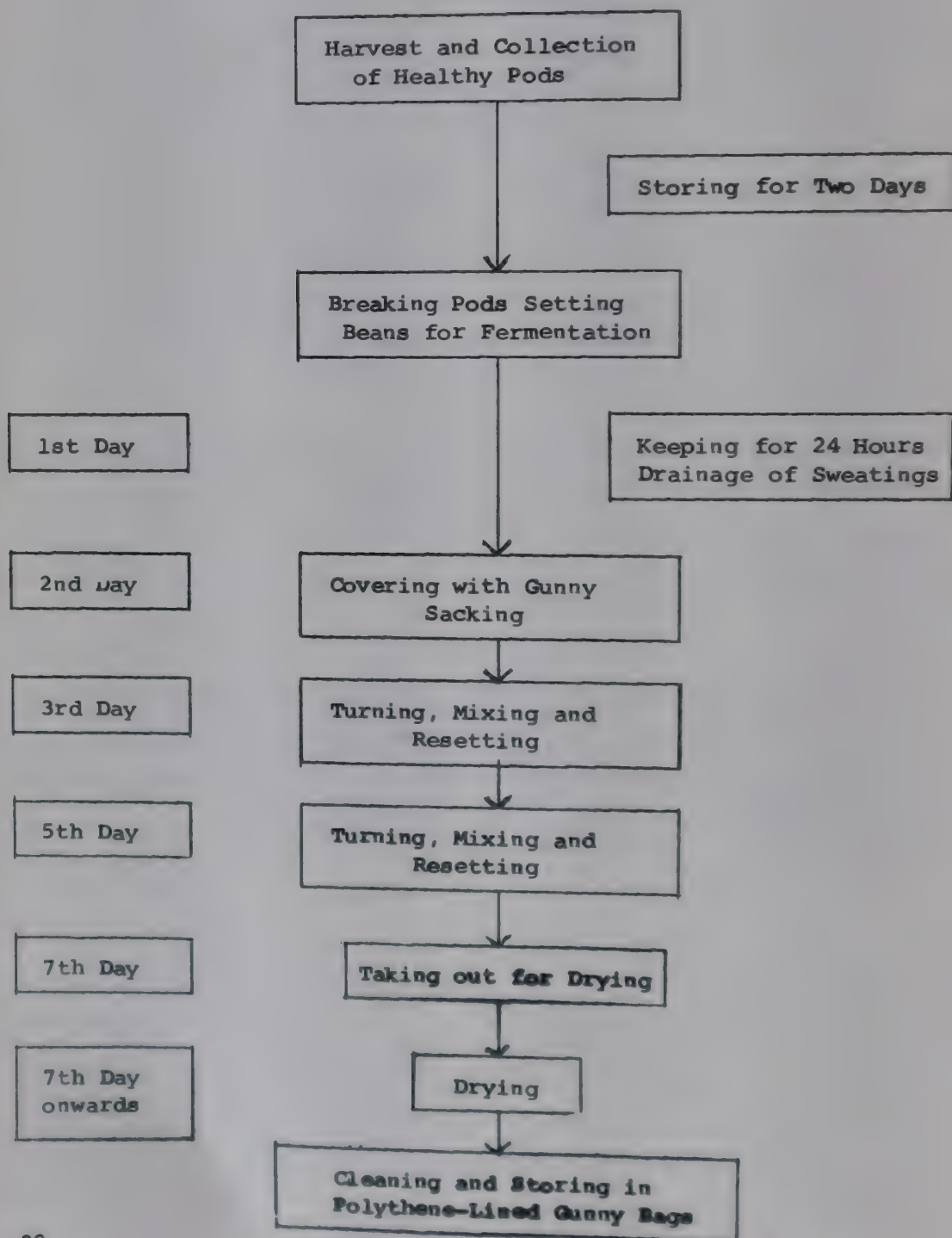
than seven days should be avoided.

DRYING : The beans are spread on mats or on a clean surface and not on ground. They are spread 3 to 5 cm. thick and are turned once in three hours. The beans should neither be heaped nor kept in closed containers at night especially in the first two or three days. Drying to the desired extent to a moisture content of about 6-8 per cent, can be achieved in 5-6 days. Properly dried beans give a crisp brittle noise and show a tendency to break when pressed. At this stage the beans are cleaned by removing flat beans, loose skin, placenta and other extraneous matter. Beans can then be stored in polythene covers.

Best results are obtained by sundrying but where climate does not permit it, the use of artificial/mechanical driers becomes essential. However, extreme care should be taken to protect drying beans from either smoke or kerosene flames or other undesirable odours.

For smaller quantities, electric devices which provide temperatures between 40°C and 45°C would be desirable. In any case slow drying at low temperatures should be preferred to quick drying at higher temperatures for good quality beans.

FLOW DIAGRAM OF SMALL-SCALE
COCOA FERMENTATION



NEW MACHINERY AND EQUIPMENT

ELECTRONICS AND ELECTRICAL EQUIPMENT

Capacitor

Two capacitors and a printed circuit connector, each with its own special features, have been introduced by a British company.

The TUT 7 tubular capacitor for high-frequency applications is claimed to guarantee low losses, low inductance and stable performance. By eliminating all soldered joints, and using high-dispersion PTFE as the dielectric, the company has provided a trimmer with mechanical stability and reliability suitable for most VHF and UHF circuitry.

With a capacitance range of 0.5 pF max-min to 7 pF min-max, and a working voltage of 1,500 V d.c., the capacitor has an insulation resistance greater than 2×10 raised to six Mohm, and operates between - 55 degree C. and 125 degrees C. The stator and rotor are of silver plated brass, and the leads are of silver-plated beryllium copper.

Other claims for this miniature trimmer are: high resistance to humidity, high insulation, and availability in a wide range of

configurations. It is also said to compete successfully with much more expensive air glass concentric designs in the UHF range upto at least 4 GHz.

The other capacitor introduced by the company, the PTU, is suitable for professional UHF and microwave applications, and is of concentric multi-turn design. Its dielectric is of polytetrafluorethylene to give smooth linear adjustment with high stability under severe operating conditions.

Mounting arrangements permit movement and very low inductance configurations in both printed circuit and stripline modules. Both body and rotor are made of goldplated brass and the ranges has a working voltage of 600 V d.c. The insulation resistance is greater than 10,000 Mohm.

The range of printed circuit connectors is claimed to have rapid insertion and exceptional retention. They are tapered for assembly into loosely toleranced holes, serrated to inhibit rotation and avoid damage to the printed circuit board, and barbed to attain high extraction force.

Manufacturers: Oxley Developments Co. Ltd., Priority Park, Ul-verston, Cumbria, England.

Agents: NJ International Corporation, Ashok Chambers, Broach Street, Bombay-400 009.

Circuit Breaker

The hydraulic magnetic design "Microbreak" is now offered with push button convenience. This new "Microbreak" special device with improved features is in addition to the standard range

of microbreaks already on the market and incorporates push on and pull off mechanism duly colour coded for instant and positive identification of off/on position.

Just like the standard model range (current ratings from 0.1 Amps to 30 Amps. both AC & DC) they are available in all types of tripping specifications such as instantaneous trip, time-delay trip, and also with application circuits like series trip, shunt trip relay trip, auxiliary contacts etc.

The improved design and construction of "Microbreak" circuit breakers with push button facility permits precise and accurate overload and short circuit protection, without the risk of heat or shock causing mechanical or electrical degradation. Installation is especially easy - single hole is drilled or stamped in the panel and the breaker shaft slides through from behind to be secured by a decorative nut. Further, the breaker is not only compact but can also be operated without discomfort in confined places.

Applications exist in virtually every industry and typically include electronic circuits, small electrical tools and appliances, lighting circuits, heaters, domestic and industrial appliances, electrical and electronic instruments, etc. The device is manufactured by Wilson & Company Private Ltd., 739, Mount Road, Madras-600 002.

Defibrillator

DC defibrillator of Bajaj Electricals is used to fight ventricular fibrillation which is a serious cardiac emergency resulting from a synchronous contraction of the heart muscle.

This instrument is designed for both instantaneous and synchronous modes of operation. The controlled placement of defibrillation discharge in the synchronised mode avoids vulnerable T-wave period. Through the paddle pick-up ECG can be displayed on a slave monitor for immediate study of the shock. The unit coupled with Bajaj Cardiac monitor and the carrying cart completes the intensive coronary care unit to tackle any emergency in the ward.

The energy level can be pre-set at any desired level 0-400 Watt-second. Charging time is less than 10 secs. and the charging wave form is damped sinusoidal having duration of 4 plus or minus 1 m.secs. The unit provides high degree of safety.

Bajaj cardiac cart, when fully equipped, carries a monitor, a synchronised defibrillator, complete mercury manometer, drip stand oxygen therapeutical equipment and tray to hold drugs and surgical instruments to make a complete self-sufficient, mobile cardiocare unit. Modular arrangement allows it to be adopted to changing requirements and has a facility to turn the monitor and the manometer through 360 degrees.

Address: Bajaj Electricals Ltd., 51, Mahatma Gandhi Road, Bombay-400 023.

Variable Frequency Inverters

A range of variable frequency inverter drives enables a.c. three-phase motors to be used in variable-speed applications, at a cost comparable with d.c. thyristor drive systems in the smaller power ranges.

This, say the British manufacturers, permits full advantage to be taken of the technical superiority of a.c.motors, which are smaller in size for a given rating, have better performance characteristics, can withstand higher temperatures, and can be operated safely in flammable atmosphere. The firm also points out that small squirrel cage asynchronous a.c.motors are readily available throughout the world.

Intended for use in pump, machine tool, conveyor and any other applications where motor speed must be controlled, the drivers are offered in two versions: the type WVFA range operates from a single-phase 220-240-V.a.c. supply (or a 380/440-V three-phase supply if an auto-transformer is used) and gives a three phase output of 10.220 V, 3-50 Hz, at power levels of 1.5 kW, 2 kW, 3kW, 4 kW and 5 kW: Type WVFB units operate from a 380-415-V three-phase supply and provide outputs of 20-380/415 V, 3-50 Hz, in the 4-15 kW power range.

Both versions are stabilised to maintain motor speed within about 2 per cent, regardless of variations in mains voltage within normal limits, and special features ensure motor stability over a wide range of supply frequencies. As the signal controlling the motor is isolated from the mains supply, the drives are suitable for computer or microprocessor-controlled applications as well as for manual speed setting.

The equipment is fully protected against motor faults and short circuits by fuses and overload protection devices. It is normally supplied with a selected range of spares to ensure maximum utilisation.

Manufacturers: W. Controls, Ashfield House, Enderby Road, Blaby, Leicester, England.

Versatile Cage Motor

General Electric Company (GEC) has developed Alpak cage motors with attractive features. As aluminium is lighter than iron, the weight of its body, which is made of aluminium, is less and this makes handling easier. As the body and components are made of die-cast aluminium alloy the appearance is very attractive.

As the fins are thinner and more streamlined and as conductivity of aluminium is more than that of cast iron the combined effects of conduction, convection and radiation over streamlined and increased dissipating surface result in quicker and better heat dissipation than in the case of cast iron body motors.

Better corrosion resistance, almost hoseproof construction, ease of maintenance and versatile mounting arrangements are its other constructional features.

Performance: the design incorporates smaller and lighter rotor which is advantageous from two viewpoints: (a) Less moment of inertia makes it more suitable for frequent starting and stopping. (b) It can be dynamically balanced to a greater degree of accuracy, thereby making it specially suitable for low vibration level applications.

The following reliability tests undertaken in the UK on standard Alpak machines demonstrate the mechanical strength and resistance to environmental damage offered by the Alpak range of motors: Sub-zero temperature operation, dust ingress test, water spray test, vibration resonance, vibration limited endurance test, superimposed mechanical shock-test and impact test.

In addition to the mechanical advantages mentioned above, electrical design has achieved optimum performance figures with regard to starting current, starting torque, pull-out torque, full-load speed, starting time, desired temperature rise, safe stalling time, etc.

Application: Lighter body, less rotor inertia and smaller vibration level make these motors specially suitable for machine tool applications. The company, it is claimed, has catered for special requirements like stator-rotor pack, modified frame, non-standard shaft, non-standard flanges, multi-speed operation with frequent reversals, etc.

For loom and carding applications specially designed surface cooled high starting torque motors are supplied. In the case of ring frame application, apart from adequate starting torque, a special lint-free cowl cover is provided.

Apart from standard three-phase motors, single phase motors are also available. In the case of singlestage pump, capacitor start and run types of motors can be supplied. These motors have three distinct advantages: (a) No centrifugal switch, thereby eliminating a source of possible trouble. (b) Capacitor is mounted separately so it is not exposed to hot air commonly available near motor surface, cooler ambient location permits longer life. (c) Better power factor at full-load.

In the case of multi-stage pump, capacitor start induction run motors can be provided which will give better starting torque.

Light body makes three-phase and single-phase capacitor start and run Alpak motors suitable for driving industrial fans.

Small compressors: Standard three-phase machines with suitable starting torque or single phase (with capacitor start and induction run) are available for such application.

Small rotor inertia and high starting torque and pull out torque make Alpak motors most suitable for crane, lift, jib and winch application.

Other general applications: Three-phase and single-phase A Alpak motors are eminently suitable for general industrial applications.

ENGINEERING EQUIPMENT

Bevel Gear Cutter

A 25 per cent increase in output and an improvement in accuracy from DIN7 to DIN6 are claimed for the improved ZFTK 250/1 straight bevel gear cutting machine developed by Modul, of East Germany. Available in the UK through William Watts Ltd., the machine is said to be intended for both large volume production as well as small/medium batches of straight crowned bevel gears upto 10 in.dia. and between 6 and 100 teeth. It employs two revolving cutter heads with blade inserts, one for each tooth flank. Productivity using this methods is claimed to be higher than for reciprocating machines and, in addition, there is a completing plunge infeed, double generating working programme, and a shorter rolling angle and path, to increase throughput further. Operating cycles are selected by electro hydraulic sequence control.

Maximum face width which may be cut has been increased from 40 mm to 45 mm and retraction is now 35 mm instead of 16 mm.

Module 10 is now possible, whereas the previous maximum was 7, and eccentricity has been extended from 110 mm to 135 mm.

Additional improvements include an enlarged magnetic swarf conveyor, hydraulics situated outside the machine for better access and easier maintenance, and a new optional stepped or steplessly variable roll feed drive.

Alternations to the pressure angle between 15 and 30 deg. as well as changes to the module or number of teeth do not require tool changes. This facility allows new gear specifications to be accommodated during a long manufacturing run with negligible loss of production.

Inquiries to: Williams Watts Ltd., P.O.Box 27, Lenton Industrial Estate, Abbeyfield Road, Nottingham NG7 2TE, UK.

Digital Combustion Analyser

Bacharach Instrument Company, US has recently introduced a new digital combustion analyser to assist combustion servicemen and consulting engineers in conducting boiler and furnace tune-ups.

This new unit has two highly visible digital displays for fast, accurate readings of oxygen, combustibles and stack temperatures.

At firing rates common to commercial and industrial boilers (330,000 BTU/Hr. and up) the improvement of just a few percentage points in combustion efficiency can result in a significant annual fuel saving.

The Bacharach digital combustion analyser permits close, fast adjustment of the air/fuel ratio to optimise excess air settings as specified by the manufacturer for each boiler load condition.

Burner operation with minimum excess air to allow for fuel, air and control system variables (without the appearance of combustibles) is the desired condition for efficient and safe operation.

The unit comes equipped with a remote probe and combustion efficiency slide rule; case is rugged, transportable, dustproof and water resistant.

For more information contact Jost's Engineering Co. Ltd., 60, Sir Phirozeshah Mehta Road, Bombay-400 001.

Floor Cleaner

Water pressure alone is required to activate powerful jets rotating at speeds of upto 2000 rev/min. in the base of an industrial floor washer introduced by a British firm.

Called the Rotor Jet Floor Cleaner, the unit can be used with any type of water pump operating at a minimum pressure of 10.5 MPa (105 bar or 1500 lbf/in²) and delivering a minimum of 20.5 litre/min. (4.5 gal/min). It looks like a conventional domestic rotary lawn mower, but in place of cutting blades it incorporates two water jets at either end of a rotating arm.

The operating principle is simple. When the pump is started water is forced under pressure through the jets, causing the rotor arm to spin and ridding the underlying surface of dirt and grease by the action of cold water under pressure alone.

A wide variety of floor surfaces with drainage facilities can be cleaned in this way, ranging from concrete and steel floors in factories, workshops and garages to ships' decks, pavements and walkways in processing plants, slaughter houses, farms and pedestrian shopping centres.

Where aseptic conditions are required, cleaning or sterilising agents such as detergents, emulsifiers and disinfectant solutions can be used, either directly applied to the floor's surface or metered into the cleaning water via an applicator unit installed in the pump.

Made of steel-reinforced glass fibre, the cleaner's square body measures 530 mm x 530 mm and is 90 mm high. It is mounted on four castors for easy movement and cleans a path 455 mm wide in one pass as it is wheeled along by means of pivoting handle.

A 3.5 mm connecting hose is supplied with the machine. One end is fitted to the rotary unit; the other end is connected to the pump's delivery hose which can be upto 30 m long. Splashing is reduced to a minimum since the water jets are contained under the machine. This enables other operators to carry out normal duties in close proximity to the cleaner while it is in operation.

The floor cleaner forms part of a range of high pressure jet cleaning equipment designed for use with the firm's range of portable wash pumps. The pump range comprises 14 diesel, petrol and electrically powered models operating at pressures between 5.5 MPa (55-138 bar or 800-1200 lbf/in²).

Apart from the floor cleaner, the cleaning equipment range comprises jetting units to clear blocked pipes and drains, a garbage, chute cleaner and a cleaning lance.

Addresses: GC Ogle & Sons Ltd., Victoria Road, Ripley
Derby DE5, 3 FX, England.

Spray Gun

A simple spray gun developed by a British firm can handle a wide variety of difficult-to-spray substances such as resins, gelcoat, lacquer, plaster, adhesives and urethane foam, apart from ordinary paints.

Designed for easy and quick use, the Polycon Industrial Spray Gun operates on compressed air and is supplied with a range of nine nozzles with bores ranging from 0.8 mm to 7 mm (1/32-9/32/in). Nozzles operate at pressures between 200 kPa and 1 MPa, depending on the flow characteristics of the substance being sprayed, rates of application are variable upto 4 litres/min.

Standard containers for spraying substances are made from polythene and are re-usable. They are offered in 0.5 litres, 1.1 litre and 2.2 litre capacitors. A 1 litre capacity disposable paper container is also available.

Nozzles and containers can be fitted to the gun in a matter of seconds. The required nozzle is simply pushed into a brass holder and secured in position by turning a retaining clip. The container, filled with the spraying material, clips easily into the gun's clamp unit, with the gun's nozzle passing through a hole in the container's lid. Container lids without holes are also supplied to enable spraying materials to be stored in the container.

Air connection to the gun is via a 6 mm (1/4 in) internal pipe thread in the air regulator valve at the base of the handle.

Spraying commences when a trigger valve is pressed and ceases when it is released. To avoid interruption when continuously spraying large surfaces, the makers recommend users to fill in advance enough containers to complete the job in hand. After use, nozzles and containers can be easily cleaned with suitable solvents.

The gun has a wide range of industrial applications. It can be used, for example, to spray gelcoat and resin on glassfibre surfaces such as boat hulls, vehicle bodies and building panels: catalysed paints (epoxy and urethane) and paints containing glass flakes or fibres; urethane foam for the thermal insulation and waterproofing of buildings and boats; cement for coating exterior walls and for assembling vinyl leather shoe components.

Other applications include spraying plaster to make moulds for reproducing sculptured art work and use by research laboratories for applying a variety of liquids, powders and fibres for experimental purposes.

Address: The Shelter Islands Company Ltd., Church House, Thrumpton, Nottingham, NG 11, GAZ, England.

METALLURGICAL EQUIPMENT

Automatic Press Welder

Advani-Oerlikon Limited has developed an automatic bench type press welder. It welds brass tags to copper or brass caps for the manufacture of high rupturing capacity (HRC) fuse caps.

The equipment has a 12-position pneumatically operated indexing table which helps continuous loading, welding and

unloading operations. A unique device called the airlock diaphragm cylinder ensures that welding takes place at a reduced pressure which is quickly followed up by increased forging pressure. The fully solid state synchronous control, with thyristor contactors, ensures precise and consistent weld quality.

The model SPN-30(PR-SP is a 30 KVA machine, other models are available. Fixtures can be designed to suit various applications both with manual loading or automatic loading. Further enquiries to: Advani Oerlikon Limited, Post Box No. 1546, Bombay-400 023.

Electrode

India's first wide range of rutile contact electrodes revolutionising manual welding productivity with deposition efficiency from 120 per cent to 180 per cent were developed by Peico Electronics and Electricals Limited.

These electrodes type C18, C23S and C23H, weight for weight, yield more useful weld metal per piece and more value for money than any other electrode. The higher productivity with these electrodes has been usefully deployed in construction of process equipment viz., storage tanks, bulk carriers, ship yards, etc.

Another innovation is the basic coated contact electrode giving 150 per cent efficiency. This electrode Philips C6 has recently been added to the production range.

Further information from Welding Division, Peico Electronics and Electricals Limited, Shivasagar Estate, Block 'A', Dr. Annie Besant Road, Worli, Bombay-400 018.

Seam Welding of Coated Sheets

Seam welding of coated-steel sheets has wide applications in the industry for products which must be resistant to corrosion and have liquid-tight seams, such as galvanised drums, petrol tanks, etc. The presence of any low-melting point coating on the surface of weldment involves some difficulty in seam welding in that the coating tends to alloy with the electrode wheels and some provision is necessary for cleaning the wheel surfaces.

Jaya Hind Sciaky has developed narrow track seam welding machines for welding of coated sheet. The machine is a longitudinal narrow track welding machine for welding galvanised drums, barrels.

The problem of electrode pick-up is solved by employing a narrow track wheel driven by a knurled driving roller to break up the alloyed material on the electrodes.

A higher electrode force is used to squeeze away the coating from the weld area to obtain steel-to-steel contact at the sheet interface. To compensate for the heat deficit caused by the coating in the weld area produced by melting of the coating, a higher rated welding transformer is provided. Other special features include epoxy encapsulated welding transformer, HINIL IC control and infinitely variable DC drive.

For further details, please write to Jaya Hind Sciaky Ltd.
DI Block, Plot No. 18/1, Chinchwad, Pune-19.

Thermocouple Attachment Unit

Advani-Oerlikon have now made it possible to correctly measure temperatures during postweld heat treatments of welded fabrication. The company has introduced a thermocouple attachment unit (TAU) which provides an ideal method of attaching thermocouples to weldments. Conventional methods used for thermocouple attachment are such that they give inaccurate temperature recorder. In fact the temperature indicated is not truly of the weldment being heat treated. As a result, errors ranging up to 50 degrees C are common. However, with Advani-Oerlikon's TAU such errors will now be eliminated.

The thermocouple attachment unit consists of a battery which is chargeable from 230 volts AC supply. This battery supplies the power to flash butt weld the ends of thermocouple wire directly on to the surface of the weldments. The wires are spaced approximately 6 mm apart. The "junction" of the thermocouple becomes the weldment itself. Thus there can be no inaccuracy in the temperature measurement. Elements and heaters can override the thermocouple "junction" and also the thermocouple as it leaves the junction area.

Advani-Oerlikon's TAU is a suitable unit, weighing only about 5 kgs. It operates on the capacitor discharge systems. The circuit consists of a solid state diode, thyristor circuit for accurately discharging the capacitor energy. The unit is extremely simple to operate. A minimum of 300 mm long twisted-pair thermocouple wire, having 10 mm asbestos sleeves pared off at the ends, can be flashed on to the weldments. All one has to do is, grip one of the wires with the pliers and hold it against the pipe where the junction is desired.

The end of the pliers is connected to the thermocouple attachment unit. In other words the pliers act as an applicator. Press the charge button until the button shows "charged". When in position, depress the button which allows the current to flow through wire and make the miniature spot weld. Repeat the exercise on the wire, holding it to the pipe surface 4 to 6 mm away from the first wire. Approximately 200 flashes can be obtained before the battery needs recharging.

The manufacturers claim the following advantages:

No welder is required to tack a thermocouple attachment to the weldment. No preheating required for welding ferrules on alloy steel pipes. No grinding required. With correct temperature measurement and control, accurate Brinell hardness values can be obtained.

For further enquiries: Advani-Oerlikon Limited, Dr. Shirodkar Road, Parel, Bombay-400 012.

Section III

INDUSTRY ROUNDUP

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

VEGETABLE OIL INDUSTRY IN INDIA

Fats and oils are not only essential parts of the diet of man and animal, but also play an important role in numerous industries, such as, paints and varnishes, soaps, cosmetics, hardened fats, textiles, leather, paper, pharmaceuticals and lubricants. Fats and oils are used as such, or are converted into edible, medicinal and industrial products. The distinction between fats and oils is merely a physical one, the oils being liquid and fats are solid at room temperature (20-30°C).

Vegetable fats and oils occur predominantly in seeds and fruits (fruit flesh). In some seeds the fat occurs almost exclusively in the germ. Fats are also produced by certain bacteria moulds and yeasts. The process of fat formation in the plant is only partly understood. The carbohydrate matters which are synthesised by the plant from carbonic acid and water are apparently converted into fat. The intermediate reactions are not fully known. There is considerable evidence that fatty acids

are produced first and at a later stage they are combined through the agency of lipase with glycerine to form triglycerides.

Significance

The oil-seed processing industry is a fundamental agro-industry of great significance for the stability and security of a country's food supply and as a basis for further industrialization. An efficient oil-seed processing industry is the starting point for the establishment of a chain of related and economically linked industries that use crude vegetable oil to produce refined oils, margarine, fatty acids, soaps, and detergents based on hydrogenated vegetable oil. The availability of oilcakes and extracted protein meal has become an important requirement for modern livestock feeding techniques. The production of oil-seed protein food products is increasingly being given attention.

An efficient oil-seed processing industry was set up in the industrialised world, to produce high-quality products for internal consumption and export. The vegetable-oil industry in developing countries like India, however, is still at a rather low level of development. Although oil-seeds and oil fruits form a natural raw material basis for the establishment of a modern, technical and economically up-to-date vegetable oil industry, the great potential of oil-seeds is still not being fully exploited in the developing world. In recent years oil-seed production has become an organised agricultural activity that supplies the world market, with the result that oil-seed processing operations have risen from the artisan and small-industry level to become a modern largescale industry that has to make use of up-to-date technologies and efficient manufacturing methods in order to become and remain competitive.

Supply and Demand

The production of oilseeds in the country is quite inadequate to meet the total requirements. The shortage is mainly in respect of oilseeds from which edible oils are obtained. Oilseeds are required mainly for production of edible oil. The requirement is, therefore, more conveniently expressed in terms of edible oil. The estimated demand and estimated supply of edible oils is indicated below:

Year	Edible oil (Lac Tons)	
	Demand	Supply
1976-77	32.00	24.00
1977-78	38.42	26.78
1978-79	35.51	28.08

The Demand Projections for Oil in India are given as:

(Quantity in Million Tons)				
	1971 (Base year)	1975	1980	1985
i) Vegetable oils	1.82	2.22	2.79	2.48
ii) Vanaspathi	0.59	0.74	1.03	1.38

Shortage

A serious edible oils shortage appears to be in the offing, despite, official pronouncements to the contrary. According to informed sources, the imports are sporadic and buffer stock position in certain regions is not comfortable, reflecting an imbalance in the distribution arrangements. The situation has assumed a serious turn with the Government eliminating private

parties from the import trade and entrusting the total responsibility to the State Trading Corporation. The STC has imported last year about five lakh tonnes of oil amounting to Rs. 300 crores. The total imports in 1977 were to the tune of Rs. 800 crores. It is apprehended that the Corporation's heavy dependence on private storage houses will create dislocation in the distribution operation. If the threat of a shortage is to be averted, the Corporation should have more control over the movement of oils.

The oilseed production, despite the initial promise of a large crop, turned out to be a disappointing one, with the two major oilseeds crops of groundnuts and rapeseed and mustard being about the same or marginally larger than the last years' low crop out-turns. Taking the five major oilseeds, the total production in 1977-78 allowing for some increase in production of sesame linseed and castorseed, could be placed around 8.3 million tons as against 7.8 million tons, in 1976-77 and 9.9 million tons in 1975-76, the latter being the highest on record. Taking also into account the production of soyabean and sunflower in accordance with the Government's practice, the total oilseeds production of these seven oilseeds for 1977-78 would come to about 8.6 million tons as against the production target of 10.80 million tons under the annual plan for 1977-78 i.e., a shortfall of 20%.

As far as edible oils are concerned, as against the estimated total requirements for direct consumption and vanaspati production, of about 32 lac tons for 1976-77 (crop year) calculated on the basis of an extremely low per capita consumption of 5.3 kg., the production was only 24 lac tons and the gap of 8 lac tons i.e., 25% had been covered by way of imports from abroad necessitating an expenditure of Rs. 500 crores or so for the total

import bill. For a country like India which is a leading oil-seeds producing country and which till early sixties was a net exporter of oilseeds and oils in the world, such heavy dependence on massive imports for meeting its very modest requirements is indeed a matter of great concern.

Government Policy

Small scale units and ancillary units are exempted from licensing provided that the following conditions are satisfied:

- i) The undertaking should not belong to one or other of the following categories.
 - a) Undertakings covered by section 20(a) of the Monopolies and Restrictive Trade Practices (MRTP) Act, 1969 i.e., undertakings whose own assets or whose own assets along with the assets of interconnected undertakings are not less than Rs. 20 crores.
 - b) Dominant undertakings covered by section 20(b) of the MRTP Act, 1969.
 - c) Undertaking belonging to 'foreign concerns' i.e., foreign companies, their branches or subsidiaries or companies in which more than 40 per cent of the paid up equity is held directly by foreign companies, their branches or subsidiaries or by foreign nationals or non-resident Indians.
- ii) The item of manufacture involved should not relate to one or other of the following category of industries:
 - a) Industries listed in schedule A of the Industrial Policy Resolution, 1956.

b) Specified Industries subject to special regulation viz.,

- Coal;
- Textiles (including those dyed, printed or otherwise proceeded) manufactured, produced or processed on powerlooms;
- Milk foods;
- Malted foods;
- Roller flour milling;
- Oil seed crushing;
- Vanaspati;
- Leather;
- Matches; and
- Distillation or brewing of alcoholic drinks.

Machinery and Equipment

The vegetable oil industry requires a wide range of very diverse machinery and accessories, depending on the process involved. The process may be broadly classified into four categories: (i) production of oil from oil-bearing materials, mostly seeds, (ii) recovery of oils from oilcakes, (iii) refining of oils and their modification to make them suitable for edible purpose, and (iv) conversion of oils into a variety of industrial products like soaps and detergents, fatty acids, varnishes, paints and resins, lubricants and specific chemicals.

Category (i) comprises machinery for cleaning, delinting (for cottonseed specially), dehulling, decorticating, deshelling, size reduction (crushing, grinding, rolling and milling), cooking and finally pressing (ghanis, rotaries, hydraulic presses and expellers). Large oil mills need elevating and conveying equipment.

Category (ii) includes essentially all types of solvent extraction units - batch, semi-continuous and continuous, having daily capacities ranging from 2 to 2,000 tonnes.

Category (iii) refers to equipment for de-gumming, deacidification, bleaching, hydrogenating and deodorizing operations, all of which may again be carried out either batch-wise or continuously.

Machinery in category (iv) is more diverse and complex. Many processes have to be carried out under high pressure, high temperature and high vacuum. Corrosive reactants may also be involved in some cases. Therefore, equipment specially designed and fabricated to withstand these conditions are required.

Many of the continuous operations require highly sophisticated equipment for controlling flow rates, levels, temperatures, pressures, pH, etc.

Import and Exports

The bill for edible oil imports which the country has had to foot in 1977-78 was staggering by all accounts, being only next to petroleum in value. About Rs. 800 crores worth of edible oils had been imported in 1977-78 crop season to meet the yawning gap between demand and supply. In 1976-77 the country spent Rs. 530 crores. The quantity imported in 1977-78 amounted to 13 lac tons, as against 9.48 lac tons, in 1976-77. Considering the lavish imports in these two years, it will not be surprising if the import figures for the present surpass the previous figures. But the mute question is whether a developing country like India can afford to spend such an enormous sum on oil imports.

In fact, the country is overdoing in imports which have exceeded the actual shortfall. As against the requirement of 34 lac tons, the production is estimated at 24 lac tons. This leaves a gap of 10 lac tons, whereas the actual imports exceed 13 lac tons. Strangely, the Government is attempting to step up the per capita consumption through imports. On top of this, Government has abandoned the exports of some of the oilseeds and their produces which can, in a way, finance the imports. The groundnut oil seed is not available for export as it is feared that its export may push up the price of ground nut oil. The export of groundnut extractions has been restricted on the ground of domestic requirements. Only 5.50 lac tons of groundnut extractions were released for export in 1978, while export can be raised to 10 lac without inhibiting the internal need.

The export of castor oil is also very restrictive. The STC can easily export about 70,000 tonnes, as against its meagre export of just 30,000 tonnes. Much more cottonseed oil cake, nigerseed and sesameseed can be exported than hitherto to foot the import bill.

The Government decision on the import policy for 1978-79 has come after a great delay. India last year imported edible oils to the tune of 14 lac tons amounting to Rs. 800 crores. In fact, the edible oils import budget ranked next only to that of petroleum oils, which was over Rs. 1200 crores during the year. India is the largest buyer of edible oils in the international market. Prices of edible oils in the international market, have ruled higher than last year. Besides, China and the Soviet Union are also in the market and, therefore, the prices are likely to rise further. The country's overall trade deficit this year so far has amounted to Rs. 600 crores and the Government has been under a severe compulsion to reduce the gap.

IMPORT OF EDIBLE OILS
(Quantity in Metric Tons)

Imports by	1977-78	1978-79
STC	5,67,752	3,39,694
Private Trade	5,61,025	3,38,448

The United States Department of Agriculture estimates that in the marketing year 1976-77 India imported 770,000 tons of vegetable oil. In 1977-78 India is estimated to have imported 900,000 tons of oilseeds and oil, on an oil equivalent basis. Upto 1 million tons of vegetable oil equivalent are likely to be imported during the 1978-79 marketing year.

EXPORTS OF VEGETABLE OILS & OILCAKES
FROM INDIA

(Value in Rs. crores)		
Year	Vegetable oils	Oilcakes
1973-74	32	171
1974-75	34	96
1975-76	36	86
1976-77	49	224

Spurt in vegetable oils exports from India

While in the entire year of 1975-76 India's export trade in fixed vegetable oils totalled Rs. 332.93 million, the export

value exceeded this level even during the first half of subsequent year 1976-77 at Rs. 335.48 million. In fact, the export earning registered a substantial rise during April-September 1976 as compared to Rs. 135.36 million in the corresponding period of 1975. Castor oil and linseed oil proved responsible for the export spurt during April-September 1976. Castor oil exports amounted to 26,568 tons at a value of Rs. 126.85 million. During 1975-76 export of this oil aggregated to 22,798 tons at Rs. 99.70 million. USSR, USA and UK were the outstanding buyers during April-Sept., 1976 at a value of Rs. 34.50 million, Rs. 30 million and Rs. 29.68 million respectively. Their imports amounted to Rs. 22.40 million, Rs. 8.94 million and Rs. 19.60 million respectively, during 1975-76.

France, Australia, Czechoslovakia, Japan, Poland and Singapore have been the other significant customers.

Linseed oil export amounted to 36,985 tons at a value of Rs. 160 million during the first half of the year 1976-77, while during 1975-76, the export was of the order of 29,328 tonnes valued at Rs. 194.67 million. UK emerged as the leading buyer during April-September, 1976 while USSR topped the list of customers in 1975-76. Aside from these two major markets, the other important buyers included Poland, Netherland, Rumania, Belgium, Czechoslovakia and Greece.

Cashew Shell oil has also been prominent in India's export list of fixed vegetable oils. The quantum and value of exports respectively were 6,730 tons and Rs. 14.93 million during 1975-76 while in the first half of 1976-77, they were 2,477 tonnes and Rs. 5.10 million.

UK and Japan have been the principal importers with UK topping the list during 1976-77 and Japan leading the previous year. USA, Korea Republic, Rumania, Australia, Czechoslovakia and Netherlands were among the other buyers. Apart from the fixed vegetable oils, animal and vegetable oils and fats in processed form were exported to the tune of Rs. 12.47 million during 1975-76 and Rs. 8.20 million in the first half of 1976-77; the major item exported in this category related to hydrogenated groundnut oil.

Important measures being taken by Government for increasing the production of oilseeds in the country are briefly as under:

- i) Raising the productivity per hectare, both in irrigated and unirrigated areas through rapid spread of improved technology;
- ii) Increasing the area under irrigated crops by exploiting the potential under the command of new irrigation projects;
- iii) Increasing the area under short duration varieties through inter and mixed cropping;
- iv) Stenghtening the seed production programme by augmenting the supply of certified seeds;
- v) Stepping up the coverage under plant protection measures, including aerial spraying in case of oilseeds over continuous areas, wherever feasible;
- vi) Fixation of support prices and undertaking purchase operations;
- vii) Provision of subsidy on the cost of certified seed and for plant protection measures;

viii) Intensification of research efforts; and

xi) Extension of area under non-traditional oilseed crops, like sunflowerseed and soyabean.

The Government feels that to meet the gap between the demand and supply, import of about one million tons would be required. There is no likelihood of the gap being met with domestic production. The deficit of edible oils and fats in the country is expected to be 2.2 million tons by 1982. It is estimated that the net deficit will increase to 2.9 million tons by 1987 if the present rate of production is maintained. These estimates are based on the presumption that population growth rate would be two per cent, per capita income 3.5 per cent and income elasticity 0.64 per cent.

(BCR & NM)

Section IV

CURRENT TECHNICAL LITERATURE

Copies of articles/documents listed in this section are available on payment of Rs 5/- for the first 5 pages or part thereof and Re 1/- for every subsequent page of the photocopy or xerox copy of the article/document. While placing the order, please mention the CTL number of the SENDOC Bulletin.

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SCIENCE AND TECHNOLOGY

- 1 ---- : Science and technology today. Interciencia, 1979, 4(5), 288-293.

Presents Pugwash guidelines for international scientific cooperation for development.

- 2 FRAME J D: The pay-offs of science for development. Interciencia, 1979, 4(5), 260-265.

Seven basic pay-offs of science to development are identified: (1) Indigenous scientific capabilities enable LDCs to engage in scientific research that is directed towards national needs; (2) the existence of indigenous scientific capabilities facilitates the training of professionals who are key personnel in the development process (doctors, medical technicians teachers, engineers); (3) indigenous science will strengthen the general problem solving capabilities of LDCs; (4) indigenous scientific capabilities will reduce LDC dependence on outsiders; (5) the existence of an indigenous scientific establishment in LDCs may enhance their ability to adapt imported technologies to local conditions; (6) indigenous science can help LDCs improve their foreign trade position; and (7) science will satisfy certain aesthetic and spiritual needs of LDC scientists who engage in it.

Appropriate Technology

- 3 HARRISON P: Small is appropriate. New Scientist, 1979, 82(1149), 14-16.

For the survival and progress of developing countries, the adoption of appropriate technology through small scale enterprises is stressed. Indian experience in this

programme is discussed.

Consultancy Services

- 4 ALLEN D H: Project evaluation. Chemtech, 1979, 9(7), 412-417.

To go ahead with a project or not to go ahead--that is always the question. The answer depends most frequently on an economic evaluation i.e. on the response to another question: Will this project be profitable? All forecasts are uncertain to a greater or lesser extent, because the project may not achieve the expected financial results. Investment and project planning decisions under conditions of uncertainty and risk require judgment in some form. but it does not mean taking decisions arbitrarily. Good judgment involves identifying, analyzing and weighing these factors relative to risks. These may be taken into account by expressing subjective judgements of uncertainties in quantitative terms and then following an explicit strategy or policy toward the corresponding risks. The techniques that are employed such as sensitivity analysis, subjective probability distributions, stochastic data, Montecarlo simulation, etc. are illustrated.

- 5 DRAPER N M: Make your consultant earn his keep. Chemtech, 1979, 9(7), 404-407.

The types of problems consultants are called upon to solve, the background and expertise they are expected to possess, criteria to be used for selecting a consultant, and the areas to be defined in the contract or letter of agreement are discussed. (JBS)

RESOURCES

Energy Sources

- 6 BASU S K & KAKAR V K: Producer gas—an alternative source of energy. *Steam and Fuel Users' Journal*, 1978, 28(3), 37-50.
Mentions the use of coal via producer gas and the technique of manufacturing producer gas. Also gives the specification of coal requirement, capacity range of plants and availability of equipment required with the list of producer gas plants in the country. Discusses the economics of producer gas plants in the country. Discusses the economics of producer gas vis-a-vis oil and its demand and supply position in the country. (SS)
- 7 DASILVA E J: Biogas: Fuel for developing countries - An overview. *ASSET*, 1979, 1(11), 10-16.
Biogas systems in recent years have attracted considerable attention as a promising approach to decentralised rural development. Some technical, environmental and operational considerations are discussed along with cost benefit analyses of methane generation. Bottlenecks in widespread use of biogas generation and R & D priorities in the field of biogas are also highlighted. (JBS)
- 8 DESAI V K: Energy-demand, supply and conservation. *Steam and Fuel Users' Journal*, 1978, 28(3), 10-37.
Stresses the importance of energy conservation and gives action plans for the same. Efficient way of energy utilization and the point to be considered for conservation of energy are discussed. (SS)
- 9 NAGAR B R & TIETJEN C: A status report on the use of biogas technology for increasing fuel and soil productivity. *Journal of Scientific & Industrial Research*, 1978, 37(9), 445-448.

This article presents a status report on the utilisation of biogas technology for increasing fuel and soil productivity, especially the developments during the past five years and also indicates the future prospects for this technology as a means of solving a number of major problems.

- 10 PEREIRA A F & WARKOV S: Energy for development in semi-arid areas of north eastern Brazil. *Interciencia*, 1979, 4(5), 272-281

This paper reports on work in progress concerning the prospects for alternative energy systems, especially solar and biomass, and the interrelationship of energy and rural development in the semi-arid areas of North-East Brazil. Based on interviews with energy specialists and governmental officials, technical reports and other published sources of information on certain aspects of energy and rural development in Brazil, the approach is 'interdisciplinary' and raises questions about some economic and social costs and benefits that may be associated with energy policy choices in this one sub-region of Brazil.

Waste Utilisation

- 11 MATHAI G: Coconut shell-a useful waste. *Science Reporter*, 1979, 16(5), 362, 324.

Discusses the commercial products that can be derived from coconut shell.

FOOD AND ALLIED INDUSTRIES

- 12 CHANDRASEKHAR T C: Essential aminoacids through fish meal for man and farm animals. *Seafood Export Journal*, 1978, 10(1), 47-50.

Discusses the necessity of aminoacids in human food and animal feed and describes the manufacturing methods of fish meal as animal feed, fish protein concentrate and fish flour. Highlights the quality aspects for acceptability. (BS)

DEVADASAN K & VENKATARAMAN R: Ribbon fish-good scope for better utilisation. *Seafood Export Journal*, 1978, 10(1), 25-28.

Examines the scope of processing of three species of ribbon fish, viz. *trichiurus savala*, *trichiurus mutius* and *trichiurus baumela* which are available in Andhra, Tamil Nadu, Kerala, Maharashtra and Gujarat Coasts. (BS)

MORRIS N: Croissants. *British Baker*, 1979, 176(3), 31.

Discusses the recipe to manufacture the baked item croissant and gives details of processing conditions. (MKSS)

SETHURAMAN K V: Elementary guidelines to start a dairy farm. *Dairy Guide*, 1979, 1(2), 7-10.

VERMA O S: Dairy entrepreneurship. *Dairy Guide*, 1979, 1(2), 41-48.

Dairy farm as a business venture needs to gearup each operation toward the production of milk. Tips for a commercial dairy are discussed. (TAV)

AND FATS

ACHAYA K T: Fatty acids: source and derivatives. *Journal of the Oil Technologists' Association of India*, 1978, 10(2), 85-86.

Possible low-cost sources of fatty acids in India, and products that might be made from them, are briefly discussed. Sources considered are cottonseed soapstock,

fish oils, minor tree oils, linseed oil, castor oil, and coconut/palm oils. (AA)

- 18 BHANDARI P G: Fat splitting project. Journal of the Oil Technologists' Association of India, 1978, 10(2), 104-110.
- 19 BOSE K: Fatty acid straight-run distillation. Journal of the Oil Technologists' Association of India, 1978, 10(2), 101-103.
- The basic requirement of a modern fatty acid straightrun distillation plant, with special reference to fatty acid derived from non-edible oils is discussed. An ideal fatty acid distillation plant consists of a continuous deaeration, drying and deodourisation unit integrated with the main distillation unit. (AA)
- 20 PINTO A E: Commercial fatty acids in India-present status. Journal of the Oil Technologists' Association of India, 1978, 10(2), 88-93.
- 21 SINGH R K: Quality standards for fatty acids. Journal of the Oil Technologists' Association of India, 1978, 10(2), 94-96.
- 22 VENKATESAN T K: Fat splitting. Journal of the Oil Technologists' Association of India, 1978, 10(2), 99-100.

CHEMICAL INDUSTRIES

- 23 GHOSE T K: Future resource of chemical and biochemical industry. Chemical Weekly, 1979, 24(30), 70-72.
- 24 KHARBANDA O P: Formaldehyde. Chemical Weekly, 1979, 24(29), 154-157.

Flow chart and equations involved in the manufacture of formaldehyde are given. Producers with their capacities in the organised sector, imports and projected demand of formaldehyde are mentioned. (MSR)

- 25 KHARBANDA O P: Furfural. Chemical Weekly, 1979, 24(29), 158-159.

Outlines the typical process, equations involved in the manufacture of furfural, producers and the demand for furfural are given. (MSR)

- 26 SONI D G: Benzene - based chemicals. Chemical Weekly. 1979, 24(29), 171-178.

Manufacture of ethers of amino phenols (phenetidines) is discussed. Demand, present status and scope of these ethers and raw materials, machinery, capital and labour required for the manufacture of these ethers are given. (MSR)

- 27 SONI D G: Benzene-based chemicals. Chemical Weekly, 1979, 24(30), 179-186.

Preparation, properties and uses of monochlorobenzene are given. Raw materials and machinery required for the manufacture of chlorobenzene in batch as well as continuous process are discussed. (MSR)

- 28 TRIVEDI H M: 500 tpa-dimethylaniline. Colour and Chemicals Weekly, 1979, 5(6), 49, 51-52.

A profile on the manufacture of dimethyl aniline is given. For a plant of 500 t capacity, the project cost is estimated at Rs 30,00,000/-. (MSR)

Chemical Process Equipment

- 29 ---- : Desk-book of chemical plant manufacturers in India. Chemical Industry Developments Annual, 1976-77, B-27-B-39.

Lists the individual units together with the addresses and the services offered. (BS)

- 30 DALAL R L & RAO M S: Chemical plant manufacture. Chemical Industry Developments - Annual, 1976-77, B6-B9.

A state-of-the-art survey reveals the enormous progress made by the chemical plant manufacturing industry in India. From its humble beginning at the turn of the century, it is now an advanced and sophisticated industry turning out products comparable to the best in the world. It has brought down the import content of the plant cost of fertilisers to 35%, of refineries to 30% and of heavy vessels to 20%. However, certain lacunae have to be removed if we have to import less and even export our plant and machinery items. The areas for development have been earmarked to achieve these goals.

- 31 PAREKH M B: Chemical plant machinery manufacturing industry and its problems. Chemical Industry Development Annual, 1976-77, B3-B5,

Briefly gives the status of the fabrication facility and design engineering know-how available and enumerates some of the vital problems of the industry. (BS)

- 32 TEWARI G C & PARGAL H K: Indian capacity in design, engineering and fabrication of chemical plant and equipment. Chemical Industry Development - Annual, 1976-77, B10-B12.

Discusses the present Indian competence in process design and engineering plant and equipment fabrication and plant erection and commissioning. (BS)

DRUGS AND PHARMACEUTICALS

- 33 ---- : Report of the working group on the drugs and pharmaceuticals industry for the plan period 1978-79 to 1983-84. Indian Drugs and Pharmaceutical Industry, 1978, 13(6), 33-42.

- 34 AKHTAR H: Role of research and development in production of vegetable drugs and phytochemicals. IDMA Bulletin, 1979,

10(12), 135-140.

Describes the agro and process technologies developed by Central Institute of Medicinal & Aromatic Plants (CIMAP), Tabulates the production, exports and imports of vegetable drugs and alkaloids. (MSR)

ESSENTIAL OILS, PERFUMES

- 35 JAIN P K et al: Study of some essential oils for their anti-fungal activities. Indian Drugs, 1979, 16(6), 122-125.

The essential oils of the leaves of *Abutilon indicum*, *Bothriochloa pertusa*, *Murraya exotica* and *Dalbergia sisso* have been studied for antifungal activities. The oils of *Abutilon indicum* and *Bothriochloa pertusa* have been found to be effective and oils of *Murraya exotica* and *Dalbergia sisso* have been found to be ineffective against tested organisms. (AA)

- 36 SURI R K et al: Medicinal potentialities and economic importance of some aromatic grasses of genus *Cymbopogon* Sprengel. Indian Drugs and Pharmaceutical Industry, 1978, 13(6), 7-14.

Reviews the work done in the recent decades, on the medicinal potentialities and economic importance of 10 species of genus *Cymbopogon*. It includes in brief the therapeutic, germicidal and antimicrobial properties besides, export and import data of their essential oils for for last 10 years. (AA)

SOAPS AND DETERGENTS

- 37 CHAKRABARTY S: The heaviness of typical operations in a soap manufacturing industry. Indian Journal of Industrial Medicine, 1978, 24(1), 3-15.

Measurements of the energy expenditures of eight different tasks in a soap manufacturing industry have been studied

and relative heaviness of the active phases of these tasks have been compared. (MSR)

- 38 KULKARNI K B: Metallic soaps manufacture and applications. Journal of Oil Technologists' Association of India, 1978, 10(2), 111-113.

Metallic soaps are salts of high molecular weight mono-carboxylic acids. Manufacturing processes, properties and industrial applications of metallic soaps are discussed. (SSD)

LEATHER INDUSTRY

- 39 ---- : Processing of garment leathers. Journal of the Indian Leather Technologists Association, 1978, 26(9), 268-276.

Describes all the aspects of a Sandoz system that has been developed to eliminate the reduced affinity of semi-chrome leather to acid dyes. (BS)

- 40 MAIRE M S & LIPSETT V A: The case for innovative tannery technology. The Journal of the American Leather Chemists Association, 1979, 74(2). 32-44.

The structure and complexity of tanning activity are being radically altered by a combination of environmental, political, and economic pressure which will continue for the foreseeable future. Under such conditions the continued viability of tanning organisations and groups is highly dependent on their rate of innovative technological progress. This paper reviews the case for technological innovation, surveys the existing technical resources of the industry, and discusses various strategies for accelerating technical progress. (AA)

- 41 PLAPPER J: Alkaline aluminium silicates as an agent in the processing of leather and fur. Leather Markets, 1979, 8(8), 13-16.

Highlights the use of alkaline aluminium silicates for washing of skins, de-pickling and de-greasing of pickled sheepskins, depickling, de-greasing and pre-tannage of pickled sheepskins and in chrome tanning. (BS)

ELECTRICAL INDUSTRIES

- 42 GOPALAN P K et al: Winding wires and cables with high temperature resistant insulations. Electrical India, 1979, 19(11), 23-28.

Enumerates different types of high temperature insulated winding wires and cables. Manufacturing details and testings of these are also given. (LKPC)

- 43 NATARAJAN R: The dynamic braking of double cage induction motors. Electrical India, 1979, 19(6), 15-18.

The double cage motor dynamic braking behaviour is studied using an approximate equivalent circuit. An equation is derived for the dynamic braking torque and the experimental braking torque is compared with the theoretical results. The running down-time of the motor with different d.c. excitations is studied and verified experimentally. (AA)

- 44 SAHAY A N: Economics of aluminium and copper conductors. Electrical India, 1979, 19(11), 17-19.

Cost analysis of aluminium and copper conductor for industrial wiring is done in case of single phase and three-phase systems and it has been found that the overall cost of aluminium wiring is cheaper to copper only for a limited number of machines (to be energised). Expressions for calculating this limit under different lay-outs have been derived. (AA)

- 45 VENKATESWARAN Y S: Types of cables and standard specifications. Electrical Contractor and Trader, 1979, 29(2), 10-15.

Describes the aims of standardisation, problems in cable industry and metricization of insulated cables. A list of ISI and IEC standards on cables is also given.

ELECTRONICS INDUSTRIES

- 46 ---- : B.B.C. codes composite color TV signal to achieve 34 Mb/s rate. Electronics International, 1979, 52(6), 71-72.

Describes a method of differentially pulse coding a composite phase-automation line (PAL) TV singnal which cuts the bit rate by two thirds to 34 Mb/s. (VVR)

- 47 FROSTHOLM R C: One-chip controller simplifies switched mode supplies. Electronics International, 1979, 52(13), 140-143.

Describes the squeezing functions and implementation of signetics NE 5560 (one-chip controller). Switched mode controller characteristics are given. (VVR)

- 48 HESS D W: Process technology of silicon integrated circuits. Chemtech, 1979, 9(7), 432-445

- 49 KUDALKAR A N & MENDKL P V: Television system & components testing by means of a pattern generator. Electronics for you, 1978, 10(8), 45-48.

Describes the various tests for which the pattern generator can be used in testing the complete television system and components. (VRM)

- 50 SUTTON C: Taking the mystery out of micro. New Scientist, 1979, 82(1155), 540-542.

The microprocessor has burst on a generally unsuspecting world, which knows little about what made it all possible. This article tries to lead the innocent through the jungle of strange jargon that surrounds these remarkable devices.

NEW PRODUCTS AND PROCESSES

CHEMICAL INDUSTRIES

Inhibitor for Prevention of Corrosion in Cooling Water Systems

The inhibitor is useful for control of corrosion in cooling water systems. The hitherto known inhibitors are suffering from the disadvantages that either they do not give satisfactory inhibition at high salt concentration present in the cooling system or they are not effective for copper and brass.

Keeping in view the drawbacks present in the existing corrosion inhibitors, investigations to develop a suitable inhibitor formulation were undertaken at the Central Electrochemical Research Institute (CECRI), Karaikudi. The investigation has resulted in the development of an inhibitor formulation which gives effective inhibition to variety of metals used in cooling system under wide variation in the composition of the cooling waters which is not possible with the individual constituents.

The process developed is very simple and consists in thoroughly mixing four different chemicals in solid form in a definite proportion. The inhibitor system is non-toxic in nature and the main advantage is the freedom from the risk of pitting corrosion.

The process has been developed at laboratory scale. 5 kg. of the product has been prepared in the laboratory at a time. The

efficiency of the inhibitor has been put to several tests i.e., (i) Beaker test; (ii) Flow test; (iii) test under rotation and (iv) circulation test rig simulating practical heat exchanger conditions.

Sodium hexametaphosphate, borax, zinc sulphate and magnesium sulphate are the main raw materials required in the process. All the materials are available indigenously. The items of equipment required are ball mill, Avery balance, polythene drum.

The total investment required to set up 30 tonnes per annum plant has been estimated at Rs 77,000, which includes Rs 22,5000 on plant and equipment. The cost of production has been worked out at Rs 6.32/kg.

Manganous Sulphate

Manganous sulphate finds application as micronutrient and in the manufacture of other manganese compounds. Besides its use in medicine and textile dyeing and calico printing, it is also used in pottery industry. Manufacture of varnishes and boiled linseed oil are some of the other areas, where manganous sulphate is used. It is also used in cattle and poultry feed.

The total production of manganous sulphate in the country is not known as it is not being produced in organised sector.

The process developed at the Central Electrochemical Research Institute (CECRI), Karaikudi involves the preparation of manganese sulphate solution by dissolving reduced manganese ore in sulphuric acid at certain range of temperature. The ore could be reduced by roasting it with carbon, coke etc. The reduction step has been worked out at 50 kg. per batch scale, the leaching at 500 litre scale.

The raw materials required in the process are manganese dioxide ore, charcoal, sulphuric acid, calcium oxide, M.S. coil. All are available in the country.

The items of equipment required in the various steps of the process are: (1) Reduction step: (a) Tumble mill, (b) Low voltage, high amperage AC transformer, (c) Balance, (d) M.S. boxes along with bricks, M.S. Coil and flat and ceramic tube, (e) Pulley block, (2) Leaching: (a) PVC-FRP conical bottom tank, (b) M.S. storage tanks, (c) Lead lined pumps, (d) Centrifuge, basket suspended type, (e) Compressor, (f) PVC-FRP cylindrical storage tank. (3) Crystallisation Step: (a) Evaporator, (b) S.S. rotary drum drier, (c) Boiler plant.

The suggested economic unit is one tonne per day. It is estimated to cost Rs 7.22 lakhs. The cost of production has been worked out to Rs 3,600/- per tonne.

ELECTRONICS AND ELECTRICAL INDUSTRIES

Battery Temperature Alarm

Battery life and performance depend to a large extent on the mode of charging. Given too high a dose, the battery will become excessively hot. This leads to much gassing in the electrolyte, resulting in corrosion of the grid and plate shedding.

In fact the service life of a lead acid battery is greatly reduced when used at temperature above 45°C. Put to work at 55°C. the battery would probably fail in a few tens of cycles.

During their investigation into the battery-failure problem at Mount Isa, Dr Rand and Mr Hamilton came up with the idea of making a device that would alert shiftworkers at the charging

station when charging is proceeding too rapidly.

The temperature in the mines is typically around 40°C and the electrolyte in the traction batteries can heat up more than 70°C during charging.

Mr Hamilton set about designing and constructing a detector, given the name Siroalarm. It is powered from the battery under test.

The detector has four light-emitting diodes. The first flashes yellow when the electrolyte reaches 55°C, an amber one comes on at 60°C. another at 65°C, and at 70°C a flashing red light and a siren provide the final warning - the battery is too hot!

Siroalarm senses temperature by means of an integrated circuit whose output has a voltage of 10 mV/°C. Four comparators, having reference voltages set at 550, 600, 650, and 700 mV respectively, sense the set temperatures.

Mr Hamilton and colleague Mr John Moresby mounted the integrated circuit in a glass tip with a Teflon sleeve and Manolok seals to protect it from the corrosive effect of the sulphuric acid electrolyte for temperatures up to 70°C.

The detector is now undergoing field at Mount Isa.

For more information: CSIRO Division of Mineral Chemistry, P.O. Box 124, Port Melbourne, Vic. 3207, Australia.

Electromagnetic Flow Meter

As per Faraday's law of electromagnetic induction, an electrical conductor, moving through a magnetic field develops an electromotive force, which is proportional to the speed of movement

of the conductor. This basic principle is used in the design of electromagnetic flow meters. In the EM flowmeter, a conducting liquid, whose flow is to be measured, acts as the electrical conductor. It is made to move through an externally created magnetic field. The EMF developed by the moving liquid is then measured and this measured voltage is directly related to the speed of the liquid movement. This method of measurement is particularly suitable for fluids (which present handling problems) such as corrosive acids, sewage, rayon viscose, acid slurries, paper pulp, detergents etc.

There are two types of EM flow meters viz. AC type and DC type. The classification is based on the fact whether the externally created magnetic field is alternating or constant. While the AC type can be used for general measurements, DC type is used for flow measurement of highly conductive fluids as the performance of AC type is unsatisfactory. It may also be noted that AC type EM flow meters are affected by mains variations, unless special attempts are made to eliminate them.

The Central Scientific Instruments Organisation (CSIO), Chandigarh has developed the design for AC type EM flow meter. The flow meter consists of a transducer and an electronic signal converter. The transducer which is mounted on the pipeline does not have any moving parts or projecting fixtures. Consequently it is unaffected by impurities in the fluids under flow. The transducer does not impose any significant pressure loss and can be installed in any position. The signal converter accepts the induced voltage from the transducer and converts it into a standard transmission signal (4 mA - 20 mA) for further use.

The laboratory has developed three prototype EM flow meters

for different diameters. Their important features are large metering range, high sensitivity, bi-directional flow measurements, PCB laid solid state circuits, and chemical compatibility with many conductive liquids.

Broad Specifications

Type	: AC type electromagnetic flow meter
Size	: 12 mm, 25 mm and 50 mm diameters
Range	: 0.5 m/sec. to 10 m/sec.
Accuracy	: 1% full scale
Housing	: Aluminium (for 12 mm and 25 mm) and steel (for 50 mm)
Liner	: Teflon (for 12 mm and 25 mm) and Hard Rubber (for 50 mm)
Liquid Conductivity	: 5 micro mhos or more
Input Signal	: 100 Meg-ohms
Output Signal	: 4 mA to 20 mA
Load	: 1000 ohms

Centre lathe, Milling machine, Drilling machine etc. are the equipment needed for manufacturing. Oscilloscope, multimeter, avometer, pumping set, water meter etc. are required for testing purposes.

For manufacture of transducers, stainless steel sheets and tubes, teflon tubes and rods, neoprene gaskets, magnet wires, electrical steel laminations, aluminium alloy castings etc. are required. IC operational amplifiers, resistors, capacitors, potentiometers, rectifiers, diodes, chassis, hardware items etc. are required for the manufacture of electronic converters.

For the manufacture of 50 nos. of electromagnetic flow meters

per annum the following investment is needed:

Fixed capital	:	Rs 65,000/- (excluding land & building)
Working capital	:	Rs 1,00,000/-

Fixed capital can be considerably less if an existing manufacturer in a related line takes up the manufacture of this flow-meter.

Terms of know-how transfer: Lumpsum premium: Rs 25,000/-;
Recurring royalty: 2%; Nature of licence: Non-exclusive; Period of licence: 7 years.

Non-Contact Type Displacement Measuring Transducer and Signal Conditioner (Model A & B)

A displacement transducer usually possesses a variable electrical parameter, which changes its value in proportion to the transducer's displacement. The variation in the parameter is usually of a low magnitude and hence additional processing of this is needed before the same could be used for applications like recording, printing etc. The varying parameter could be resistance, capacitance, inductance etc., depending upon the characteristics of the transducer.

The National Aeronautical Laboratory, Bangalore has developed two types of displacement transducers of the capacitance type. The principle of operation for both are same, but they differ in construction details and specifications.

Model A is a capacitance type transducer, with a live electrode incorporated in it. Another metallic conductor is kept in the vicinity of electrode as a second electrode (which is generally grounded) and with air as dielectric. the arrangement forms a capacitance. The movement of the ground electrode in the active

range of sensor varies the capacitance. By measuring the capacitance (or the change in the capacitance) the displacement could be measured. The transducer is excited by a highly stable 5 KHz sine wave oscillator. The specifications for the device are given below:-

Sensor type	Full scale Range	Resolution Microns % FSR	Overall accuracy (5% to 100% of full scale) % FSR Microns	Sensitivity
CT01	1.0	1.67 0.167	±0.75 7.5	6V/mm
CT02	2.0	3.33 0.167	± 0.75 -15	3V/mm
CT03	3.0	5.00 0.167	± 0.76 -22.3	2V/mm

The signal conditioner consists of an amplitude stabilised oscillator, FET input operational amplifier followed by AC/DC converter. The instrument can operate either on battery or on mains. The high level DC output can be indicated on a digital voltmeter or on a CRO depending on the application.

Model B is a long stroke linear displacement transducer, based on variable capacitance principle. Two concentric cylinders form the capacitor electrodes with air as dielectric. Capacitance variation is obtained by the movement of a plunger (kept at ground potential) inside a hollow cylinder (kept at a fixed potential). The variation in capacitance between the plunger and the hollow cylinder is a measure of the displacement. The plunger is brought into contact with the moving objects whose displacement is to be measured. The associated signal conditioner helps to convert the capacitance variation into voltage variation. Thus, measuring the difference in voltage, before and after the displacement, the actual amount of displacement can be indicated. The transducing

capacitor is excited with an alternating voltage of about 1V rms at 5 KHz.

The signal conditioner is similar to that of the earlier type. The specifications are given below:-

Range	:	50 ■ full scale
Non-linearity	:	Less than $\pm 0.2\%$ fsd
Resolution	:	Better than $\pm 0.05\%$ fsd with the associated amplifier and suitable readout equipment.
Accuracy	:	Better than $\pm 0.5\%$ fsd
Frequency response	:	0 to 600 Hz flat
Without spring assembly	:	-3 dB at 1 KHz
Sensitivity	:	0.1 V/■
Ambient range for the transducer alone:		+10°C to +120 ° C
Ambient range for the instrument alone:		+10°C to +50°C
Nominal dimensions	:	1) 120 ■ x 120 ■ x 40 ■ (Instrument)
	2)	(a) 25 ■ dia x 260 ■ length (transducer with spring)
		(b) 25 ■ dia x 205 ■ length (transducer without spring)

Raw material/components are: Non-magnetic stainless steel rods, teflon rod, transistors, diodes, I.C.'s, resistance, capacitors, transformers, P.C.B. switches, terminals, coaxial cable, BNC connectors, Metal boxes, pilot lamps etc. All the materials are available indigenously, except Hybrid type FET input operational

amplifier, which will have to be imported.

NAL has estimated an annual demand of 500 numbers. This will have to be ascertained, when planning regular production. The cost of production approximately works out to Rs 800/- for the capacitance arrangement and Rs 4,000/- for signal conditioner.

Facilities for sheet metal fabrication, lathe, hand tools, micrometer dial gauge, AF sine wave generator, digital multimeter, oscilloscope etc. are needed. All are available indigenously.

The fixed capital requirements (excluding land & building) is estimated at Rs 50,000/-. Working capital for the manufacture of 100 transducers p.a. will be Rs 1,25,000.

Terms of Know-How Transfer : Lumpsum premium: Rs 11,000/-;
Recurring Royalty: 3% on sales; Nature of licence: Non-exclusive;
Period of licence: 7 years.

Wow and Flutter Meter

"Wow and Flutter" is defined as frequency variations due to speed fluctuations occurring at the rate of 0.1 Hz to 200 Hz. Due to mechanical imperfections in the drive/transport mechanism of tape recorders/turn table, the reproduced sound suffers from distortions due to speed fluctuations. These distortions can be measured with the help of "Wow and Flutter Meter" so that remedial actions are taken to keep these within tolerance limits. As such this is an indispensable measuring equipment at all the studio centres of All India Radio.

The "Wow and Flutter Meter" consists of a FM discriminator to detect the frequency variations, filters to select the wow and flutter components and a meter for visual indication. A 3150 Hz

frequency source is provided in the unit as a signal for recording on a tape recorder whose speed variations caused by its mechanical transport system are to be measured. The tone is played back and the playback output is fed to this instrument for measurement of wow and flutter. The equipment works on 240V, 50 Hz single phase mains supply.

The Research Department of All India Radio, Ministry of Information and Broadcasting, New Delhi has developed a solid state "Wow and Flutter Meter". The unit has gone successfully through field trials and performance has been found satisfactory.

Specifications of the product

Input Voltage	:	100 mV to 1 Volt (R.M.S.)
Input Impedance	:	300 K ohms (un-balanced)
Range (Full scale):	:	0.1%, 0.3%, 1%, 3%
Accuracy	:	Without 2% of full scale reading
Wave-form effect on accuracy	:	Independence of wave-form
Filter (Built in)	:	i) 0.1 Hz to 10 Hz (Wow) ii) 10 Hz to 200 Hz (Flutter) iii) 0.1 Hz to 200 Hz (Wow and Flutter)
Frequency Response:		
Unweighted	:	Within - 1 dB from 4 Hz to 100 Hz, it is - 3.5 dB upto 200 Hz
Weighted	:	As per I.E.C. and ISI standards
Oscillator (Built in)	:	i) Frequency 3150 Hz $\pm$ 5% ii) Output level: 0dBm (Preset)
Output terminals	:	Available for oscilloscopic observations
Dynamic Characteristics	:	As per I.E.C. and ISI specifications

Power Source : 24W $\pm$ 10%, 50 Hz $\pm$ 2% single phase
(5 Watts)

Mechanical : i) Physical dimensions-

Length 390 mm

Breadth 220 mm

Height 250 mm

ii) Weight 9 kgs. (approx)

The unit is very useful in all the studio centres of All India Radio and also it will be of immense use, wherever tape recorders are used.

The main components required are carbon film resistors, metal film resistors, trim potentiometer, cermet potentiometer, polycarbonate capacitors, electrolytic capacitors, transistors, integrated circuits (741 operational amplifier), diodes, zener diodes, bridge rectifiers, reed relay, push button switches, D.P.S.T. switch, transformer (240 V/12.5V - 100 mV - two windings and 30V - 25 mV) indicating meter (0 - 1 mV). All these components are indigenously available.

No special plant and machinery is required for manufacturing this item. The manufacturer should have sufficient technical background, experience and standing in the production of professional grade systematised general electronic equipment.

The main test instruments required are beat frequency oscillator with provision for external frequency modulation, wave analyser, cathode ray oscilloscope, frequency counter, function generator, distortion and noise level meter, multimeter, and dual DC power supply. All these test instruments except beat frequency oscillator and wave analyser are available indigenously. The cost of production per unit is Rs 6,000/- approx.

FOOD AND ALLIED INDUSTRIES

Asafoetida

The Central Food Technological Research Institute, Mysore has standardised a technique for the preparation of a good quality compounded asafoetida (hing) in powder and tablet forms.

Such compounded flavours for food preparations are designed to provide retention of flavour characteristics, ease and convenience, with long shelf life.

Asafoetida, the oleogum resin, obtained from the stem and root of *Ferula* plants that are mainly grown in Afghanistan and Iran, has a very strong flavour, and has, therefore, to be diluted before use. It is marketed in the compounded form using diluents like gum arabic, edible starch or cereal flour.

Commercial asafoetida, owing to its high moisture contents, often develops molds on the surface, especially when packed in polyethylene bags, and its quality varies from lot to lot. The CFTRI technique overcomes these problems.

The quality of asafoetida depends on its volatile oil content which provides its characteristic odour. CFTRI has developed a simple method to determine the flavour strength in asafoetida.

Jack Fruit Preparations

Jack fruit (*Artocarpus integrifolia*), also known as Kathal, Phamas, Halasu, etc. in different parts of India is grown abundantly throughout the warmer parts of the country.

Jack fruit nectar - Nectar is prepared from ripe jack fruit having succulent bulbs. The fruit is cut into small pieces. The

bulbs are separated out from the rind and the surrounding carpels. The top and bottom of the bulb are trimmed off and the seeds together with their thin covering are removed. The bulbs are cut into small pieces or slices.

Fruit pulp is prepared by heating the cut pieces slowly in about half their weight of water and stirring with a wooden ladle. The softened pieces are mashed into fine pulp by crushing them thoroughly and rubbing the pulp through a fine mesh to remove large pieces. Sugar syrup (60° Brx) is prepared by dissolving 1.5 kg. sugar in 1 kg. water and heating. The scum is removed and the syrup is filtered.

Recipe

Pulp	5.00 kg.
Sugar	11.25 kg.
Water	7.50 kg.
Citric acid	235 g.

Different ingredients are blended and strained. Potassium metabisulphite (preservative) (17 g) is added for use of the product over a longer period. The preservative is dissolved in a small quantity of water and the solution is mixed with the product.

The nectar is kept in dry, sterilized, air-tight bottles, which are stored in a cool and dry place. Jack fruit nectar is a palatable beverage with a pleasant taste and aroma. It is diluted with 4-5 volumes of water before use. It may be taken as such or after carbonation.

After removing the bulbs from the fruit, the remaining outer rind, the inner soft portions and the trimmings from the bulbs are

boiled with an equal quantity of water (by weight) and 0.3% citric acid for 30 min. The extract is drained off. The residue is re-boiled with half the quantity of water for 15 min. and drained again. The two extracts are mixed and set aside for setting. The extract is tested for pectin. One kg. sugar and 7 g. citric acid per litre of clear extract are added. The mixture is cooked till the temperature of the boiling mass is 105.5°C (at sea level) and till it gives the sheeting test. The finished product is poured in clear, sterilized glass jars placed on a wooden board. The jelly so obtained is stored in a cool and dry place.

MINERAL BASED INDUSTRIES

Copper Ruby Crystal Glassware

The manufacture of coloured crystal glassware has been recently taken up in India. In this category, the copper ruby crystal glassware is attractive and profitable, and is much sought after in the local as well as foreign markets. The process of production of both the cased copper ruby crystal glassware and the through-coloured copper ruby glassware has been developed by the Central Glass & Ceramic Research Institute (CGCRI), Calcutta.

In the CGCRI process, the blank glass used for making uncoloured crystalware is not changed; only the minor ingredients for obtaining copper ruby colour are added to the batch mixture. The process eliminates the use of costly constituents like zinc oxide and boric oxide. As a result, the cost of production is reduced by about 50%. The batch is melted under a controlled furnace atmosphere for a specified period until it is ready for working.

To make copper ruby cased crystalware the copper ruby glass is applied as a thin film on the colourless crystal body and is

annealed with an appropriate time-temperature schedule to obtain the desired ruby colour. Selenium ruby glass is not suitable for this purpose and hence copper ruby glass is used in developed countries for producing cased crystal tablewares.

The through-coloured copper ruby molten glass can be shaped to obtain thick rods for supply to those manufacturers who would not like to invest in the production of copper ruby glass direct from the batch.

Cement-like Product from Paddy Husk Ash-Jorhat Process

A new process has been developed in the Regional Research Laboratory (RRL), Jorhat, to produce a cheaper cement-like material for use in masonry and foundation work. In this process paddy husk is utilized to produce a cementing material for use in masonry mortar, plastering, foundations and mass concrete work. About 4 million tonnes of paddy husk-ash estimated from the annual rice production in the country, can be processed to produce this cementing material. All equipment used in the process is indigenously available or can be fabricated. The cost of production of this cementing material is Rs 175/- per tonne approximately as against Rs 400/- per tonne of portland cement. The process involves: (i) collection of raw material, (ii) mixing the ash with a binder and treatment, and (iii) packing in water-proof bags for end-use.

Tests carried out according to Indian standard specification and other standards specified in literature on this cementing material have given the following results.

Tests	Paddy husk cement	Standard values for masonry mortar
Setting time:		
Initial	70-130 min.	120 min. (min)

Tests	Paddy husk cement	Standard values for masonry mortar
Final	3-6 hrs.	24 hrs. (max.)
Compressive Strength		
1:3 cement standard sand by volume or 1/4 by weight water at 110% flow		
7 days strength	20-35 kg/cm ²	3-20 kg/cm ²
28 days strength	50-80 kg/cm ²	7-40 kg/cm ²
Water Retention:	65-75%	70% (min.)
Concrete for use in foundation at 1:4:8 proportion at 11% water-vibrated		For foundation concrete work
28 days compressive strength	40 kg/cm ²	10 kg/cm ² (min.)
29 days flexural strength	2-8 kg/cm ²	2 kg/cm ² (min.)

Advantages claimed for this paddy cement are: (i) low cost of production, (ii) the capacity of plant can be designed according to the availability of raw material, and (iii) in different filling area separate mini-plants can be set up unlike other cement plants without affecting much the cost of production.

Further, the laboratory has also undertaken the Research and Development work to produce cement from paddy husk ash equivalent to portland pozzolana cement and the process has already been developed on laboratory scale, i.e., 25 kg. batch by following single step method. The physical properties of paddy cement equivalent to portland pozzolana cement are mentioned below alongwith the Indian Standard Specification requirements. The up-scaling work is in progress.

Test	Actual value	Specified value as per IS : 1489-1967
1. Setting times (minutes):		
a) Initial	15 to 25	not less than 30
b) Final	90 to 120	not more than 600
2. Compressive Strength:		
Paddy cement - sand mortar cubes (1 paddy cement: 3 standard sand) by weight - kg/cm ² at -		
a) 3 days	160 - 202	not specified
b) 7 days	210 to 240	not less than 220
c) 28 days	320 to 400	not less than 310

The physical properties of the paddy cement developed in the laboratory indicate very high potential to produce paddy cement equivalent to ordinary portland pozzolana cement and it may be an economically viable process for the developing countries.

Further 1 tonne per day pilot plant studies are being undertaken.

Peshawar Process

Rice husk is difficult to incinerate and does not burn in a way other organic substances do. Efforts were, therefore, made to design an incinerator which should give rice husk ash with minimum organic carbon and desired activity.

A 45 galloon used MS oil drum (dai 22") was converted into an incinerator. A grill was placed 6" above the base. Two doors 8" x 6" were provided, one below and the other above the grill. The lower door was used for starting the fire initially and

controlling the air draught, whereas the upper door was used for withdrawing the ash. A separate chimney, with 4" dia. window, was placed on the top of the drum. No extra fuel was required except to start the burning. The process of burning is self-sustained and do not require any adjustments or control. However, the burning of rice husk ash was found to be incomplete. The design of the incinerator was modified by placing two wiregauze cylinders of 3" and 21" dia. The rice husk ash was found satisfactory for making cement. (patented)

Two types of cement were made i.e. (i) lime rice husk ash and (ii) lime burnt clay in the ratios of 30:70 and 30:50:20 respectively.

The RHA is first ground in a disc grinder which reduces the material to about 80-100 mesh. The ground material is further mixed with lime and ground to get the surface area of 4,250 sq.cm per gm. (Blaine) in a conventional rod mill. The advantage of the disc grinder is that it reduces the grinding time in the rod mill to 1¹/₂ - 2 hours for a charge of 50 kgs.

PROPERTIES OF RHA CEMENT. The table below gives the physical properties of the two cements:

Cement type		H	HS
Loss on Ignition	-	8.0%	7.0%
Fineness (Blaine)	-	4200 sq.cm/gm	4250 sq.cm/gm.
Bulk Density	-	0.75	0.83
Specific gravity	-	2.10	2.30
Water for normal consistency	-	60%	56%
Soundness (Le Charterier expansion in %)	-	Nil	Nil

Cement type	H	H	HS
Setting time	-	Initial 165 mins.	355 mins.
		Final 255 mins.	595 mins.
Compressive strength		3 days 1550 PSI	1137 PSI
		7 days 2340 PSI	1726 PSI
		28 days 2730 PSI	3085 PSI

Synthetic Mullite and Mullite Corundum

Central Glass & Ceramic Research Institute, Calcutta has developed a process for the manufacture of synthetic mullite and mullite corundum. The process is specially significant because of the increasing demand of high alumina refractories of superior quality for stringent applications in steel plant and other industrial practices. The requirements of sintered alumina materials is met essentially through imports as these are not indigenously manufactured. Fused grains, as substitutes, are however being produced in the country since the last few years. The process utilises Bayer's alumina and clay, and affords a high grade sinter at temperatures of 1550-1600 °C as compared to 2000 °C or above, needed for fusion. Minor amount of mineraliser has been used to bring down the sintering temperature without deterioration of the quality of the end-product to any appreciable extent.

Quality of the product : Performance of the aggregates in developing high alumina brick was carried out by a leading refractory manufacturing unit. The properties as shown below, attained on refractories made by the firm out of the aggregates supplied by CGCRI, were found to be highly satisfactory.

Properties of refractories made from aggregates

Properties	Sintered mullite-corundum	Sintered mullite
Al ₂ O ₃ %	80 (approx)	70 (approx)
Porosity%	17.0	16.0
Linear change on firing to 1660°C from dry state (%)	-1.25	-2.2
Refractoriness under load	1760	1640
ta°C	(therefore deformation very slow)	(10% sus subsidence at 1760 C)
X-ray diffraction results	(Corundum (major) Mullite (medium)	Mullite (Major)

Although precise break-up figures for high alumina refractories is not available, the requirement is of the order of 20,000 tonnes and will increase, if available at a competitive price. The aggregates should find applications for making high grade monolithics. In view of the limited sources of availability of these materials in the world, there is a potentiality for export also.

All the raw materials are available indigenously. The main raw materials are:- (i) Fireclay/china clay, (ii) Bayer's alumina hydrate, (iii) Mineraliser (0.5-1.0%)

Plant & Equipment: (a) Indigenous - Crusher and grinder, magnetic separator, ball mill, briquetting machine/palletiser, filter press, kiln, vibroenergy mill, moulds, accessories and quality control laboratory. (b) Imported:- Briquetting machine/palletiser if not indigenously available.

For plant producing 500 tonnes of the material per year, the following investment will be required: Fixed capital on Building Rs 0.30 lakhs; Capital on plant Rs 2,30 lakhs; Working capital Rs 5.50 lakhs.

NEW MACHINERY AND EQUIPMENT

CHEMICAL PROCESS EQUIPMENT

Double Disc Pump

Double disc pump, a newly introduced product developed and made by Fluid Transfer Limited, represents a significant development in the design of positive displacement pumps. The tough resilient discs reciprocate in opposition. The cavity created between the discs is progressively filled and exhausted by the action of the discs to create a smooth continuous flow. The discs also act as valves alternately sealing discharge and suction at each stroke, thus eliminating external valves altogether for simplicity and reliability.

The pump is free from glands and rotating seals; it is glandless in the conventional sense in that separation of the hydraulic and mechanical parts is achieved using two flexible disc components which are attached to both drive rod and casing and absorb the drive movement as well as creating a liquid barrier.

In addition to and because of these unique features, the pump is able to handle solids in suspension up to 12" in size, slurries of all kinds, liquid/air/gas mixtures, and process liquids as found in the chemical industry. The pump will dry prime up to 10" HG, and once primed will handle suction lifts to 8 m. and beyond. Indefinite dry running will not damage the pump, due to total absence of rubbing surfaces.

Pumps are available in aluminium, cast iron and stainless steel with casing coatings if required and a range of internal "wetted" parts materials is available for chemical duties.

This pump is of great relevance to the chemical industry, and can be used to advantage where the following is a consideration:

(a) Solids or slurries are to be handled, (b) Liquid and solid mixtures where the solids are subject to mechanical damage in ordinary pumps, (c) Liquid/Gas mixtures, (d) Liquids of medium viscosity, (e) Semi-metering is required, (f) Some dry running is inevitable, (g) Dry priming and high suction lifts are required.

For further details please contact: Fluid Transfer Limited, No. 923608, Griffin Mill Estate, Thrupp, Stroud, Gloucestershire, England GL5 2AZ. Filter: Nellie

Said to be the only design of its kind in the world, a totally enclosed mobile, stainless steel filter unit called Nellie has been introduced for general industry by British Filters, its developer. The filter, which was designed originally for the brewing industry, will eliminate suspended particles from water to an optically clear standard at the rate of 13,600 litres/hour, yet it can be moved easily to any part of an industrial plant by a company's own maintenance staff where it will occupy only half the space needed for a conventional filter press.

The filter mats, which contain diatomaceous earth and cellulose, are carefully processed to form a medium which is radically different from any previously known filter. The whole filter is made up of 150 self-supporting sheets, each approximately 0.258 m^2 and giving a total area of 39 m^2 , enclosed in a stainless steel

cylinder. Pressure resisting endplates hydraulically compress the filter sheets between stainless steel sealing rings.

Unfiltered water enters through a central port and passes to the corrugated surfaces of the diatomaceous earth mats. These are self-supporting and carry their own feed and drainage channels, eliminating the need for expensive filter plates and making the best possible use of space. Water passes through the mats into the channels of the ribbed surface and escapes through alternate sealing rings into the outlets ducts.

Four types of mat are available to accommodate different flow requirements and suit the condition of the water input. Washing-back will clean the mats and lengthen their operational life.

For details contact: British Filters Ltd., Thames Industrial Estates, Fieldhouse Lane, Marlow, Buckinghamshire SL7 1TD, England.

Industrial Dehumidifiers/Air Dryers

Artic India dehumidifiers remove moisture from the air through a process of continuous physical adsorption - the simplest, most direct method of humidity control. Water vapour is absorbed on the drying (process) side of the dehumidifier in a perforated metal desiccant filled bed, rotating clockwise at a few rev/hr. This desiccant holds the moisture while the bed is rotated to a second chamber where moisture is expelled and the desiccant regenerated by heated air drawn through the bed by the reactivation fan. These desiccant type dehumidifiers are successfully controlling humidity in the following fields: environmental control/manufacturing/material storage/product drying: Pharmaceuticals,

computer and data processing rooms, drying ovens, explosives, dyes, food products/processing, textiles, drugs; storage of hygroscopic materials, fertilisers, corrosive metals and finished components, photographic and other paper; drying of plastic granules (Complete range of special plastic dryers is offered, etc.). Advantages of Artic India desiccant type dehumidifiers over conventional refrigeration type are: it removes bacteria, reduces relative humidity to as low as 1% constant enthalpy operation; does not increase heat in room; no voltage regulation, stabilisation required; offers energy recovery options; occupies 1/2 to 1/3 Eu.ft.space of refrigeration unit.

For further details contact: Artic India Sales, 20, Rajpur Road, Delhi-110054.

ELECTRONICS AND ELECTRICAL EQUIPMENT

Electrosafe

Bajaj Electrosafe is an instrument to "check the instruments which check the patients". It is the most valuable safeguard against all dangers of electrical hazards. It measures the maximum current that would flow through a subject under extreme condition. The degree of hazards from electrical leakage is thus determined knowing the nature of application and condition of subject.

It can also indicate both AC and DC current leakages. The scale provides direct accurate reading from 1/4 of a micro amp to 1 milli amp in 3 ranges 10-100-1000 micro amps.

The input resistance is 100 ohms. Input leads and circuit elements are insulated from the case and all exposed material.

There is an extreme hazard lamp which glows, when leads have been connected directly across a power line or other source. It works on two, 9V dry batteries.

Address: Bajaj Electricals, 51, Mahatma Gandhi Road,
Bombay-400 023.

Front-Panel LEDs

Rather than design circuits that convert pulses from complementary-metal-oxide-semiconductor or transistor logic devices into signals capable of driving light-emitting diodes, engineers can now purchase LEDs with driver circuitry built in. Called the fan-in-series, the front-panel indicators come in red, amber, and green and are housed in cylindrical cartridges.

The lamps are available in models that light on receiving a logic 1 or 0 and with a variety of lenses, including ones with custom legends. Most lenses are of the fresnel type and have either regular or low-profile front-panel projections. At 20 mA, they have a minimum average life-time of 10 years.

In quantities of 100 or more, standard LEDs are priced at 2.93 a piece.

For details contact: Data Display products, 303 North Oak St., Ingle wood, Calif. 90301.

Limit Switch

A rotary cam limit switch, type E803, which has been introduced by Cutler-Hammer Europa Ltd., is offered in latched and non-latched 2, 4 and 6 cam versions each suitable for use with or without a gearbox. A flexible coupling can be provided for connecting switches together when 8 and 10 way combinations are

required. Nine gearbox ratios are available as standard in single, double and triple reduction.

The switch is connected, usually by switch-mounted gearing, to the application drive so that one complete travel or cycle effects one complete revolution of the switch shaft (non-reversing) or a maximum 300 deg. rotation (reversing). Contacts can be arranged to operate at any point of rotation to give, for example, slow down, supervisory indication or small motor switching. The latched type can be used through the full range of 0.60 r.p.m. Below 20 r.p.m. the latched type switch only should be used.

The contacts are made up of two, four or six contact blocks independently operated by the cams or dogs. Each contact block has two poles which are double break and can be either N.O. or N.C.

Five standard cam angles are available: 15, 27, 50, 95 and 170 deg. A 360 deg. blank can also be supplied for cutting to suit special requirements.

Inquiries to: Cutler-Hammer Europa Ltd., Igranic Works, Elstow Road, Befford MK42 9IH, England.

ENGINEERING EQUIPMENT

Clutches and Brakes

For applications which call for acceleration or braking of large flywheel masses, a range of pneumatically operated units designated models 0.442 and 0.452, are now being offered by Soag Machinery Ltd. Manufactured by Ortlinghaus, the range comprises pneumatically engaged, spring released, clutches and spring applied

pneumatically released, brakes available in one, two or three plate designs. All types are said to be well suited for main drives of presses, press brakes, shears and punching machines as well as machines used in the construction, marine and mechanical handling industries.

A notable characteristic of the series is the low inertia of the inner parts which, together with the inner ventilation of the plates, gives good heat dissipation. All units are self-adjusting for wear, and running temperatures remain within allowable limits at high engagement frequency and continuous running conditions, it is stated. Both clutches and brakes have identical elements incorporated in their design so that spare parts such as friction linings, seals, etc., are interchangeable.

The range includes clutches for torques ranging from 125 to 42,000 nM and brakes from 90 to 33,000 nM. Models for higher torque requirements can be supplied on request.

Inquiries to: Soag Machinery Ltd., Transport Avenue Industrial Estate, Great West Road, Brentford, Middx. TW8 9HB, England.

Copy Punch Press Nibbling Facility

The model CS20a copy punch press, by Trumpf Machine Tools Ltd., combines the high speed of a punching press with the capabilities of copy and co-ordinate nibbling. This is said to result in a versatile sheet metalworking machine which can economically produce cutouts of any shape or size in sheet metal (up to 12mm. thick) or plastic, irrespective of batch size.

The facility for copy nibbling extends the field of application of a punching machine which is most suitably used for the mass production of identical cutouts. Limitation of cutout size

is eliminated and complex cutouts whose production would normally necessitate the use of a costly punching tool, can be produced economically and quickly, it is claimed.

Any number of tools in any desired sequence can be used, and their subsequent adjustment is not necessary as the tools are clamped in the upper and lower tool adapters.

Punching and nibbling tools can be interchanged in 10-15 sec. it is stated, while fast changeover to other sheet metal-working operations, e.g. shearing, slotting, cutting, beading, folding, flanging and peening is also possible.

Design features of the machine include rigid ram guiding which ensures the precise guiding of the tool and promotes long tool life and a clean working result. A further advantage of this feature is that the punch can be loaded off-centre to enable the sheet to be notched with standard punches.

Inquiries to: Trumpf Machine Tools Ltd., Lyon Way, Hatfield Road, St. Albans, Herts, AL4 0LI, England.

Machining Centre: Control System

It has been announced by Beaver Machine Tool Sales Ltd., that their NC5, NC5S and NC5-ATC vertical NC milling machines and machining centre are now available with the Posidata 2800 CNC control as an optional system choice. This control system normally employs stepping motor drives for the three machine axes and optional rotary table and knee drive. Closed loop axis drive alternatives are available.

Full facilities are provided as standard, with simultaneous interpolation, program store and edit, manual data entry, subroutine programming and inch/metric switching.

Programming is simplified through use of repeat cycles and machine utilisation increased by application of the storage/edit and punch out features, it is stated.

Information is relayed to the operator via CRT display which details machine command and operation data and additionally provides warning statements for errors and malfunctions.

Inquiries to: Beaver Machine Tool, Sales Ltd. Heaver Works, Sweet Briar Road, Norwich NR6 5AJ, England.

Milling Cutters

A range of milling cutters for machining heat resistant and corrosion resistant alloys, used extensively in the production of supersonic aircraft, has been developed by Hall and Pickles Ltd., in co-operation with British Aerospace Aircraft Group. Designated Hydralock Aero-space, the range comprises endmills and slot drills providing a complete package to companies engaged in machining super alloys on numerically controlled machines.

The cutters, manufactured in M42 high speed steel and sensitively heat treated, are available in three cutting lengths, short, medium and long, to give maximum rigidity. Following heat treatment they are flute ground to a consistent lead angle for each diameter to remove any inaccuracies in flute milling and spiral unwind to ensure teeth are accurately spaced. Shank diameters are ground to a tolerance of 0.005 mm.

A range of pre-set adaptors, manufactured from high quality nickel-chrome steel, carburised, hardened and accurately ground are offered for use with the cutters. These are supplied with bore diameter to matching shank diameters with 40 or 50 ISO mountings.

Inquiries to: Hall and Pickles Ltd., Hydra Works, Ecclesfield, Sheffield S30 3ZF, England.

METALLURGICAL EQUIPMENT

Cordless Soldering Iron

The Weller cordless soldering iron has been developed by Copper Tools for use by both technicians and hobbyist.

The iron, the Weller WC10C, operates from long life nickel cadmium batteries which enables solder connections to be made without the iron being connected to a power outlet. This gives considerable freedom to the soldering function and is therefore ideal for in-the-field applications.

A fast power charger which plugs into any 240V outlet is supplied with the iron. The charger is connected to the iron to regenerate the full charge in the nickel cadmium batteries. This provides the iron with a fast heat-up time of six seconds and an operating temperature of 700F/370C.

The iron is styled to comfortably fit the hand and has a red control button which is slid forward to operate. In order to protect the batteries from being accidentally discharged or damaging surrounding objects, the button can be slid back into safely lock position. To assist the soldering operation in poorly lit conditions, the iron is fitted with a prefocussed lamp on the front of the housing.

Three interchangeable tips are available for the iron. To change the tips, two recessed screws in the iron housing are removed and the tip slid out. All tips have a shell, manufactured from nickel-plated copper which is then hot-tin dipped to give effective protection from oxidation.

For further information contact: Cooper Tools Ltd., Wear District 6, Tyne and Wear, NE37, INA, England.

Ultrasonic Flaw Detector

Baugh and Weedon, Limited, Widemarsh Street, Hereford HR4 9EZ claim that their PA1011 mini compact ultrasonic flaw detector is the smallest and lightest on the market. Nevertheless, they say, high performance is attained with resolution and sensitivity capabilities equal to larger and much more expensive instruments - the result of using up-to-the minute design technology and components.

The instrument weighs only 4.5 kg. (10 lb.) and measures 131 mm. ($5\frac{1}{8}$ in.) high, 180 mm. ($8\frac{1}{8}$ in.) wide and 287 mm. ($11\frac{1}{4}$ in.) deep and is designed to be strong enough to withstand the rough treatment it is likely to receive during on-site work.

Applications include detection of internal defects and cracks, corrosion monitoring and control, checking for correct assembly and weld inspection in a wide variety of engineering materials.

The PA1011 is said to be capable of detecting flaws over a depth range in steel, for example, from less than 10 mm. ($3/8$ in.) to approximately 7 m. (23 ft.). Tests can be carried out using singleprobe, double probe and separate transmission and receiving probe methods with an operating frequency in the range of 0.5 to 15 MHz. High screen brightness and good accessibility of controls help to make the PA1011 easy to operate. The input attenuation range of 0 to 80 dB is calibrated in 2 dB steps for accurate measurements of changes in signal amplitude, while an uncalibrated gain control allows fine adjustment during calibration.

Time base delay is continuously variable up to 300 mm. (in steel) while suppression is continuously variable up to the equivalent of signals at twice full screen height. Operation is from an internal rechargeable battery with sufficient capacity for a normal working shift.

Portable Welding/Cutting Unit

A small portable oxy-acetylene welding and cutting set which carries its own power source and a comprehensive range of equipment has been developed by a British firm.

Mounted on a lightweight trolley, the Portapak offers users a versatile workshop on wheels, enabling them to perform a wide variety of duties which call for comparatively small quantities of gas. With its full range of equipment, the trolley weighs only 32 kg. (75.5 lb). Its overall measurements are 1 m high 450 mm wide x 320 mm deep, small enough to be packed into the boot of a car. It is particularly suitable for work in locations difficult to reach with the much heavier and bulkier gas welding equipment conventionally used. Since the power source travels with the equipment, jobs can be done more conveniently particularly at height, without the need for long and unsafe trailing hoses between cylinders and equipment.

Applications range from fusion welding of sheet steel up to 8 mm (5/16 in) thick and cutting through steel plate up to 20 mm (1/4 in) to brazing, hard soldering, bronze welding and heat treating. Industrial/commercial uses include the repair and maintenance of motor vehicles, bicycles and agricultural machinery and equipment; work on steel erections at building and construction sites; in shipyards; and in heating, ventilating and plumbing installations. Other uses include rescuing accident victims from

wreckage, and the makers believe that the equipment will also appeal to the handyman since it offers a relatively inexpensive means of carrying out a wide variety of repair and maintenance jobs in and around the home or farm.

Finished in epoxy resin for service under all conditions, the trolley incorporates a tool box which holds all the components and accessories supplied, apart from components already assembled for use. The tool box lid has a useful quick-reference chart showing gas pressures required for various welding and cutting applications. Standard items include a welding and cutting torch, cutting and welding attachments with five nozzles, a gas mixer, two regulators, two 2.5 m long 5 mm diameter hoses and a plastics tube holding different types of welding rods. Accessories include a battery operated spark lighter, a pair of goggles, spanners and nozzle cleaners. An easy-to-follow instruction manual with additional welding and cutting information is also supplied with each set.

Manufacturers: BOC Ltd., West Pimbo. Skelmersdale, WN8, 90A, England.

INDUSTRY ROUNDUP

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

BEET SUGAR INDUSTRY IN INDIA

1 Introduction

In India, the modern sugar industry began in the early 20th century; but the industry made tangible progress only after 1932. By 1937 the Sugar Syndicate was established and by 1944 the Indian Central Sugarcane Committee was constituted for cane research and, since independence various commissions and committees have been making recommendations for accelerating the growth of the industry. Thus, the industry today is in a position to meet indigenous demand fully, coupled with some exports. From 32 working units in 1932, the number rose to 130 by 1935-36 and to 253 by 1976, with a total installed capacity of well over 50,00,000 tonnes and an actual production of 65,00,000 tonnes.

2 Present Status & Future Scope

Roughly 47% of the total world sugar is manufactured from sugar beet. Presently, beet sugar is emerging as the best complement for sugar and it has already found its place in north India. States like Punjab, Haryana, Rajasthan and Western U.P. grow these

as a winter crop so that beet can be diffused immediately after cane crushing is over. Beet sugar is widely used in the pharmaceutical industry. Since the beet molasses have more sugar content than sugar molasses, it is used in sizable quantities in the manufacture of vitamin B and citric acid. The recovery rate of sugar beet is 11.5% against 8.5% from sugarcane. Due to these favourable factors, the co-operative sector and other private mills are seriously considering the production of beet sugar.

Beet sugar has been produced for the first time in India by the state owned Sri Ganganagar Sugar Mills in Rajasthan. During 1975-76 the plant diffused 242,000 quintals of beet and produced 25,687 quintals of sugar. The recovery percentage rose to 11.70 against the earlier average recovery of 10.1 per cent. The yield per hectare also improved from 9 tonnes to 20 tonnes.

In India, systematic investigations on sugarbeet cultivation were undertaken by the Indian Institute of Sugarcane Research, Lucknow in 1959. In 1960-61 coordinated experiments on various agronomical aspects were initiated at the Sugarcane Research Stations/Institutes in Punjab, Haryana, Uttar Pradesh, Bihar and Karnataka. The overall results showed that sugarbeet is a 7 month crop and could be successfully cultivated as a winter crop in the irrigated plains of north India and was capable of giving a yield of 30-35 tonnes of roots with 15-16 per cent sugar content.

A collaborative pilot project on cultivation and processing of sugarbeet was taken up by the Indian Institute of Sugarcane Research, Lucknow and the National Sugar Institute, Kanpur in 1964-65. The British Sugar Corporation's subsidiary Sugarbeet Development Limited is working to promote sugarbeet industry as consultant.

Table 1
YIELD OF SUGARBEET IN DIFFERENT STATES
1959-69

S t a t e	Number of trial loca- tions	Total number of trials conducted	Mean yield of roots in tonnes per ha.
Punjab	9	12	49.2
Haryana	2	5	44.3
Uttar Pradesh	11	23	38.7
Gujarat	7	12	37.3
Maharashtra	10	17	35.4
Rajasthan	4	6	32.2
Bihar	5	6	32.8
Madhya Pradesh	3	6	39.5
Andhra Pradesh	3	3	26.1
Karnataka	4	4	25.0
Tamil Nadu	3	3	22.6
West Bengal	5	5	17.8
Orissa	1	1	8.4

Commercial scale sugarbeet crops were raised in the fields of farmers in the sugar factory areas of Yamunanagar in 11.5 hectares in 1964-65 & 1965-66, Bhogpur in 23 hectares and Sriganganagar in 26 hectares in 1967-68. The average yield were 31.0, 41.0 and 32.5 tonnes/hectare, respectively.

It was observed that sugarbeet could be successfully handled and processed in the above said existing sugar mills having carbonation process after installation of diffuser, slicer, beet washer etc. during the summer months of April and May, after the cane season was over in March or early April, with a sugar recovery of

Table 2

WORKING RESULTS OF THE GANGANAGAR SUGAR MILLS ON SUGARBEET

Year	Agricultural			Technical			Financial	
	Area in ha.	Production in tonnes	Yield in tonnes per ha.	Sugar recovery per cent	Sugar production in days	Sugar production in tonnes	Cost of sugar production per qtl.in Rs	Gross profit (+) loss (-) in lakh Rs
1970 - 71	96.0	879	8.8	3.55	5	1.1	4166	(-) 1.65
1971 - 72	455.6	2751	6.0	6.26	14	174.9	953	(-) 12.70
1972 - 73	759.6	11402	14.5	8.57	36	959.8	366	(-) 11.08
1973 - 74	1124.8	9475	8.4	10.20	30	1002.8	335	(-) 5.01
1974 - 75	714.0	5616	8.0	9.78	19	566.5	519	(-) 11.59
1975 - 76	1225.0	24211	20.0	10.61	47	2583.7	317	(-) 1.28
1976 - 77	1200.0	32823	27.2	9.78	64	3230.4	320	(-) 20.72
1977 - 78	1120.0	33632	30.0	9.10	69	3082.0	331	(-) 30.22

10.0 to 11.0 per cent. Thus, sugarbeet held possibilities of supplementing sugar production from sugarcane and improving sugar recovery where it ranged between 8.5-9.0%. Due to poor calorific value of pulp (bagasse) of beet, extraneous fuel like furnace oil or coal would be needed to use.

A centrally sponsored scheme was launched in 1970-71 in the Ganganagar Sugar Mills, Sri Ganganagar in which a beet diffusion equipment was installed at a cost of Rs 90.5 lakhs including machinery and buildings. In 1971 the scheme was extended to the Phalton Sugar Works, Sakarwadi in Maharashtra and in the Fifth 5 year plan it was envisaged to take up sugarbeet development in 17 sugar factories (which already had carbonation process) in north western India.

The data on agricultural, technological and financial performance of the Ganganagar Sugar Mills are given in Table-2.

During 1978-79 with the reduction of price of beet roots from Rs 16.00 to Rs 11.50 per quintal, the area under the crop around the sugar mills has come down sharply from 1120 hectares in 1977-78 to 666 hectares. The requisite area under sugarbeet for optimum feeding of the sugar mills is only possible at fair price level. The cost of production of sugar even after 8 years of working of the beet project is as high as Rs 331 per quintal. The sugar mills have sustained losses ever since it undertook beet sugar production. During 1976-77 these were over Rs 20 lakhs and in 1977-78 these further rose to Rs 30 lakhs.

Phalton Sugar Works was closed after 1975-76 due to difficulties in commercial production of beetsugar. The beet extract after diffusion of cossettes was mixed with cane juice. As such,

no beet sugar was produced in this factory as has been the case in the Ganganagar sugar mills. No other sugar factory, as proposed in the fifth 5 year plan, came forward to install the necessary beet processing plant.

Techno-economic Analysis

It will be seen from the foregoing that sugarbeet is successful in north western India and it presents no special technological problems: the problems may be the extraneous fuel and financial viability. To ensure that there is no interruption in fuel supply, coal may have to be stored well in advance of commencement of beet processing season, provided, the sugar mills may have sufficient space and funds for this purpose.

A beet sugar project of 700-800 TBD costs about Rs 250 lakhs these days. The financial forecast of annual working of an existing carbonation sugar factory with equipment installed for beet processing is given in Table-3. The production cost of beet sugar works out to be Rs 378 per quintal against about Rs 225 of cane sugar on an average of 5 working seasons, which is very high. The beet project sustains a cash loss of about Rs 160 lakhs at the end of 5 years. Another Rs 20 lakhs would be needed every year from the 4th year onwards to pay off the instalment of term loan. At the end of 5 years, a sugar factory would require about Rs 200 lakhs to wipe off the losses and honour its commitments to the financing institutions. Thus, while sugarbeet production is agriculturally and technologically feasible, beet sugar manufacture is not financially viable in the prevailing circumstances in the country.

Table 3

**FINANCIAL FORECAST OF ANNUAL WORKING OF AN EXISTING SUGAR FACTORY
(carbonation) FOR INITIAL PERIOD OF 5 YEARS WITH EQUIPMENT INSTAL-
LED FOR PROCESSING SUGARBEET**

Sl. No.	Particulars	Unit	Y e a r				
			1st	2nd	3rd	4th	5th
1.	Installed capacity	TBD	700	700	700	700	700
2.	Average campaign duration	Days	30	45	60	60	60
3.	Expected processing	TBD	400	600	700	700	700
4.	Total quantity of sugarbeet expected to be processed	Tonnes	12000	27000	42000	42000	42000
5.	Expected average sugar recovery	Percent	8.0	9.5	10.0	10.5	10.5
6.	Total production of sugar	Bags	9600	25650	42000	44100	44100
7.	Total production of molasses (5% of beet)	Tonnes	600	1350	2100	2100	2100
8.	Production of pulp at 55% of beets	Tonnes	6600	14850	23100	23100	23100
9.	Realisation from sugar, Rs 200 per quintal	Lakh Rs	19.20	51.30	84.00	88.20	88.20
10.	Realisation from molasses, Rs 60 per tonne	Lakh Rs	0.36	0.81	1.26	1.26	1.26
11.	Realisation from pulp, Rs 5 per tonne	Lakh Rs	0.33	0.74	1.16	1.16	1.16
12.	Total realisations	Lakh Rs	18.99	52.85	86.42	90.62	90.62

Sl. No.	Particulars	Unit	Y e a r				
			1st	2nd	3rd	4th	5th
13.	Working expenses	Lakh Rs	12.00	18.00	28.00	28.00	28.00
14.	Cost of beet including transport and taxes at Rs 140 per tonne	Lakh Rs	16.80	37.80	58.80	58.80	58.80
15.	Depreciation on Rs 250 lakhs at 10% per year	Lakh Rs	25.00	25.00	25.00	25.00	25.00
16.	Interest on term loan at 15% on Rs 200 lakhs	Lakh Rs	30.00	30.00	30.00	30.00	30.00
17.	Interest on working capital at 15%	Lakh Rs	0.61	1.64	2.68	2.81	2.81
18.	Total expenses	Lakh Rs	84.41	112.44	144.48	144.61	140.11
19.	Gross operating profit (12-18)	Lakh Rs	(-)64.52	(-)59.59	(-)58.06	(-)53.99	(-)49.49
20.	Cash loss (after adding back depreciation)	Lakh Rs	(-)39.52	(-)34.59	(-)33.06	(-)28.99	(-)24.4
21.	Payment of instalments of principal	Lakh Rs	-	-	-		
	Total cash loss	Lakh Rs	160.65				
	Payment of instalments of principal	Lakh Rs	40.00				
			200.65				43

3. Process Details

Sugar beets are transported by trucks to the plant where they are weighed and unloaded by side dumpers. Leaves and weeds along with beets in the flume are separated in a trash catcher. Rocks and coarse sand are separated from the beets by a rock catcher. Intensive agitation with simultaneous addition of water removes addesive dirt and sand from the beets. Remaining leaves, rocks or other foreign matter can be removed manually.

Washed beets are cut into strips (cossettes) in the slicer, weighed and moved into an extraction unit consisting of cossette-mixer and diffusion tower. The cossettes are mixed with hot juice inside the cossette mixer and are then pump-fed into the bottom part of the diffusion tower.

Sugar extraction : As the cossettes move up towards the top of the diffusion tower, hot water is applied as extracting liquid. Leached cossettes, are pressed to extract remaining sugar. The diffusion juice, discharged through screens at the bottom of the diffusion tower, is heated to raise sugar concentration. Colour of raw juice is a greyish black.

Purification & Filtration : The raw juice has to pass through several steps to remove non-sugars and other impurities. Raw juice is alkalisied in precarbonation tank by recycling in limed juice from the intermediate limiting tank while simultaneously adding carbon-dioxide (CO_2) from the lime kiln to achieve a pH of 8.8-9.0. The juice is fed to the first carbonation tank to treat with carbon dioxide gas. Next the muddy juice is heated againt and pumped to the thickener, where the mud (CaCO_3) can settle out. Filtrate from the drum filters is heated together with the clear juice and treated again with CO_2 in the 2nd carbonation. Colour of clear juice

obtained is light yellow. For further refinement of colour, sulphur dioxide (SO_2) is passed to the juice.

Evaporation : After the juice, (at approx. 13% solid), has been treated in several stages it is concentrated in 4-stage evaporator to a content of about 65% dry substance. Standard liquor is made by mixing thick juice to B-sugar and C-sugar. This liquor is treated with carbon and filtered enough and heated to crystallisation stage to get 'massecuite' mixture.

Crystallisation : Massecuite is discharged from the vacuum pans into the A-product centrifugals to separate crystals from syrup at a very high speed. The crystallized sugar is dried in a granulator. After cooling, the sugar is conveyed via elevators to silos. Syrup separated in the A-product centrifugals is further desugarised in the B-product vacuum pans where it is thickened until crystallization. This material is less pure and poorer in colour.

In the B-product centrifugals, the light yellow sugar separated from the syrup is dissolved again to prepare standard liquor. By means of another crystallization in C-product vacuum pans, additional sugar can be recovered as crystals. To get more crystals, the crystal syrup mixture (C-massecuite) is discharged from the vacuum pans into cooling crystalizers, where, C-sugar and run off are separated.

While the C-sugar returns to the dissolving station, to be used as a component of the standard liquor, the run off (molasses) cannot be used in any further process recycling. Although the molasses consist of approx 50% sugar, concentration of the non-sugars is so high that no further crystallization is possible. Hence, the molasses is stored for use in other industries.

Pulp Drying and Pelleting : Pulp extracted and pressed, still, has a water content of approx. 80 per cent. Pulp is dried on oil fired rotating drying drum to 10 per cent moisture level. The dry pulp is conveyed to the pellet presses. Due to their good nutrient content the pellets serve as high-quality cattle feed.

Auxiliary agents, such as milk of lime and carbon dioxide gas, required for the juice purification, are produced in the lime station by burning lime rock with a certain amount of coke.

4 Consumption

As against a production of over 60,00,000 tonnes, domestic consumption of sugar is roughly over 45,00,000 tonnes. Now, it might go upto 57,00,000 tonnes. The per capita consumption of sugar is insignificant in India, compared to other countries. In 1975, the figure stood at 6.2 kg. whereas it was 25.2 kg. in Japan, 31.4 kg. in Malaysia, 38.9 kg. in Europe; the world average is 19.6 kg.

5 Exports

India, which is a signatory to the International Sugar Agreement has committed itself to export 6,50,000 tonnes of sugar in 1978. But, the performance and functioning of the STC in this regard, is reported to be unsatisfactory. Table-4 explains the export trend.

Table 4

Year	Quantity of Sugar	Value of Consignment
1973	2,48,000 tonnes	Rs 422 million
1974	5,00,000 tonnes	Rs 2144 million
1975	13,00,000 tonnes	Rs 4750 million
1976	8,43,000 tonnes	Rs 2686 million

6 Conclusion

As said earlier, beet sugar manufacture is not a viable proposition. The same is true of the new cane sugar factories. In the recent past, the cane sugar projects have been made viable through policy decisions of the Government. The same line may have to be adopted in the case of the future sugar projects. In the areas which have been found suitable for sugar beet cultivation (Punjab, Haryana and Western U.P.), there are 23 sugar factories with carbonation process; a process which is a must for beet processing. Their combined crushing capacity is about 35,000 TCD. These factories would be able to handle about 22,000-25,000 TBD. Taking a beet season of 55-60 days and sugar recovery of 10.5 per cent, the total beet sugar production in these factories would be 1.25-1.55 lakh tonnes per year. However, the capacity to manufacture beet sugar machinery in the country is limited. At best it may be possible to set up about two beet processing units a year. Thus, in five years hardly 10 such units can be expected to be installed at the expense of Rs 250 million or more. Their total production would not be more than 50,000 tonnes of beet sugar a year and which is equivalent to one day's production of our existing cane sugar mills. This is a very small quantity when viewed in the light of 65 lakh tonnes of sugar production in 1977-78.

There is little or no possibility of improving overall sugar recovery through sugarbeet in the wake of introduction of high-sugar varieties of cane. The cost of production of beet sugar is higher than that of cane sugar. There is a problem of storage and likelihood of disruptions in the supplies of extraneous fuel for beet sugar manufacture. The contribution of beet sugar to the national sugar pitty at best is likely to be very small. On the other hand, good potentialities are available for the production of sugarcane and hence sugar from it. (MKSS)

Section IV

CURRENT TECHNICAL LITERATURE

Copies of articles/documents listed in this section are available on payment of Rs 5/- for the first 5 pages or part thereof and Re.1/- for every subsequent page of the photocopy or xerox copy of the article/document. While placing the order, please mention the CTL number of the SENDOC Bulletin.

Subject Index	CTL No.
Agro-Industries	54-56
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RESOURCES

Energy Sources

- 51 KAKAR V K: Gobar-gas plant & the dairy farmer. Dairy Guide, 1979, 1(9), 45-49.

Remedies to technical difficulties in the proper handling of gobar-gas plant are discussed in detail.

Increasing gas production during cold season, uses of gobar-gas plant, and suppliers of machinery and their cost range are also covered. (MKSS)

- 52 HAYES D : A solar-powered world by 2025. Chemical Take-off, 1979, 8(5 & 6), 18-21.

WASTE UTILISATION

- 53 DURGAPAL B C et al : Effective utilisation of paddy wastes. Indian Chemical Journal, 1979, 14(5), 29-32.

Describes the utilisation of rice bran for the extraction of edible oil and the utilisation of paddy husk and paddy husk ash for bricks. Gives the flow chart for manufacture of bricks from paddy husk, financial data for 3000 tons paddy husk ash cement per annum and flow diagram for making brick from paddy husk ash. The availability of rice bran oil, paddy husk and paddy husk ash from rice crop in different states of India are given in a tabular form. (KSDR)

AGRO INDUSTRIES

- 54 KRISHNAKUTTY SATYAVATI et al: Home preservation of split coconuts. Indian Coconut Journal, 1979, 10(5), 3-4.

A simple treatment for home preservation of unused opened coconut cups is standardised. Smearing the surface of split coconut with vinegar will prevent microbial spoilage for 24 hours. By repeating the smearing with vinegar every day, preservation can be extended to even 4 days.

- 55 MANIMEGALAI G & NEELAKANTAN S : Coconut and its utilisation. Indian Coconut Journal, 1979, 9(12), 5-7.

Describes the availability, usefulness, importance, composition and processing of coconut products. Composition of coconut products is given in table. Two home recipes in coconut, namely, coconut boli and banana coconut cake are also presented. (MKSS)

- 56 REDDY N K et al : Post-harvest technology of coconuts. Part I. Component parts of Indian Coconuts. Indian Coconut Journal, 1979, 10(4), 3-7.

Data on constituents of Indian coconuts, characteristic content ranges of coconuts and percentage of nuts within content range are given. (MKSS)

FOOD AND ALLIED INDUSTRIES

Dairy Products

- 57 --- : Dairy byproducts for biscuits. Dairy Guide, 1979, 1(9), 33-35.

Byproducts like lassi (butter milk from whole milk curd) creamery butter milk, cheese, cheese-whey, ghee residue,

etc. could be used in the preparation of biscuits.
Recipes for biscuits using each byproduct are given
(MKSS)

- 58 BHATTACHARYA D C et al : A technique for the production of bhapa dahi. Indian Journal of Dairy Science, 1979, 32(2), 168-172.

Standard method for the preparation of Bhapa Dahi on commercial scale is discussed and supported by flow diagram. (MKSS)

- 59 SINGH S et al : Effect of phospholipids and method of manufacture on flavour and keeping quality of ghee. Indian Journal of Dairy Science, 1979, 32(2), 161-167.

OILS AND FATS

- 60 PILLAIYAR P : Post-stabilisation changes in rice bran. The Journal of the Oil Technologists' Association of India, 1979, 11(1), 16-18.

The extent of infestation and development of the FFA content in stabilised and unstabilised brans stored in gunny and polythene bags are reported. (MKSS)

- 61 PILLAIYAR P : Rice-bran oil-potentiality, characteristics and method of extraction. Kisan World, 1979, 6(2), 10-11.

Discusses the scope, composition, potentiality, characteristics and method of extraction of rice bran oil. (MKSS)

- 62 PILLAIYAR P & KUTHARATHULLA Md B : Pelletization of parboiled rice bran. The Journal of the Oil Technologists' Association of India, 1979, 11(1), 9-15.

Solvent extraction industry experiences difficulty in pelletizing parboiled rice bran. In continuous solvent extraction plants, extraction of pellets of parboiled

rice bran formed without any additive result in poor extraction and heavy hexane loss. Conditions required for pelletizing parboiled rice bran without incorporating any additive have been worked out.

PAPER, PULP AND ITS PRODUCTS

- 63 ---- : Demand growth of paper units. Perfectpac, 1979, 19 (6&7), 13.

- 64 ---- : Paper plants from bagasse. Chemical Weekly, 1979, 24(3), 63.

Discusses the possibility of setting up of small paper, Citric acid-and furfural plants based on bagasse with the cooperative sugar factories in Maharashtra.

- 65 COOPER D: Extrusion laminated reinforced products, TAPPI, 1979, 62(2), 83-85.

The paper presents an overview of manufacturing techniques, comparative performance, and new developments in the area of extrusion laminated reinforced products.

End-use applications including reinforced corrugated board stock, lumber wrap, and steel wrap are discussed. together with considerations for the selection and use of various reinforcing materials. (AA)

- 66 SINGHANIA H S : Review of paper & board industry. Perfectpac, 1979, 19(6&7), 12.

CHEMICAL INDUSTRIES

- 67 ---- : Speciality solvents from methylamine. Indian Chemical Journal, 1979, 13(12), 26-30.

Methylamine-based solvents include dimethyl formamide, dimethyl acetamide, HMPT, N-methyl diethanolamine etc.

The uses of these solvents are highlighted. The uses of dithiocarbamates based on dimethylamine are discussed. (KSDR)

- 68 KHARBANDA O P : Glycerine. Chemical Weekly, 1979, 24(29), 160-163.

Typical process, products, future end use pattern of glycerine are given.

- 69 KHARBANDA O P : Hydrogen peroxide. Chemical Weekly, 1979, 24(29), 168-171.

Gives a flowchart for the preparation of hydrogen peroxide, present capacity, imports, exports and demand of the products are given.

- 70 KHARBANDA O P : Isopropyl alcohol. Chemical Weekly, 1979, 24(30), 172-175.

Typical process, producers, future, end use pattern of isopropyl alcohol are given.

- 71 KHARBANDA O P : Linear alkylbenzene sulphonate. Chemical Weekly, 1979, 24(30), 176-181.

Typical process, equations involved and requirements for the manufacture of linear alkyl benzene sulphonate are given. Production, imports and use pattern along with manufacture of the product are also presented.

- 72 KHARBANDA O P : Maleic anhydride. Chemical Weekly, 1979, 24(30), 182-185.

Flow diagram for the manufacture of maleic anhydride producers, future demand and use pattern of the product are given.

- 73 KHARBANDA O P : Melamine, Chemical Weekly, 1979, 24(30), 186-189.

Process, producers, demand, use pattern and trends of melamine are given.

- 74 KHARBANDA O P : Methanol (Methyl alcohol). Chemical Weekly, 1979, 24(30), 190-195.

The process, producers with their capacities, end use pattern, future trends of methanol are given.

- 75 MAGARI F : The trends of industrial chemicals trade in 1978 and prospects for 1979. Chemical Economy & Engineering Review, 1979, 11(8), 17-22.

Gives the industrial chemicals trade balance by main countries, by regions in 1978, by main markets in 1978 and reviews the trends by industries and products. (BS)

- 76 WANI V G : Corrosion and its prevention. Indian Chemical Journal, 1979, 14(3), 34-37.

Describes the electrochemical theory of corrosion and the preventive measures for corrosion. Gives the corrosion prevention processes developed at Central Electrochemical Research Institute, Karaikudi.

Chemical Process Equipment

- 77 BASU A K : Chemical engineer and the process plant equipment industry. Indian Chemical Engineer, 1979, 21(1), 3-6.

Reviews the achievements and capabilities in the aspects of software which include the engineering, detailed engineering, construction management and the like; and hardware which includes the manufacture and fabrication of process equipment. (BS)

- 78 MAZUMDAR A H : Maintenance management in chemical industries (Part V). Maintenance costs and performance. Chemical Industry News, 1979, 25(5), 267-275.

Highlights the aspects of maintenance costs and different approaches to measure productivity and presents the results of the survey conducted for this purpose. (BS)

- 79 MAZUMDAR A H : Maintenance management in chemical industries. Part VII. Training for upgrading maintenance function or job enrichment. Chemical Industry News, 1979, 24(7), 435-439.

Discusses the aspects of upgrading maintenance function and gives the results of the survey conducted for this purpose. (BS)

- 80 MICHAEL PAGE : Low pressure cleaning system makes less mess. Process Engineering, 1979, (April), 105.

Cleaning rusty equipment can present environmental problems to the plant operator. Describes a new air-blasting process and outlines its advantages.

DRUGS AND PHARMACEUTICALS

- 81 ---- : Palatable Isapgol granules. Chemical Industry News, 1979, 24(7), 462.

Gives the profile of the product developed by Central Drug Research Institute, Lucknow, which deals with the process details, raw materials, equipment, and economics. (BS)

- 82 GANAPATHI K : The present status of the drug industry and the future scope. IDMA Bulletin, 1979, 10(45), 600-601.

Reviews briefly the present status and future scope of the drug industry in India. (BS)

- 83 KULKARNI S P & MANECK S P : Good manufacturing practices. Pharmatimes, 1979, 11(8), 7-12.

Explains how good manufacturing practices can be adopted

in a typical pharmaceutical manufacturing unit. (BS)

- 84 SHENAI V A & PAI N R : Benzocaine as a local anaesthetic. Indian Chemical Journal, 1979, 13(12), 31-33.

Describes the synthesis of benzocaine, its properties, applications and uses. The synthesis of the raw materials required for the synthesis of benzocaine is also given. (KSDR)

LEATHER INDUSTRY

- 85 ---- : Lacquer CA. Chemical Industry News, 1979, 24(7), 463.

Gives the profile of the product developed by Central Leather Research Institute, Madras which deals with process details, raw materials, equipment, utilities and economics. (BS)

- 86 BANSAL A S : Marketing assistance to shoe makers under the schemes of Khadi and Village Industries Commission. Indian Footwear, 1979, 3(2), 38-40.

- 87 CHELLAPPA S : An estimation of the production and consumption of leather in India. Leathers, 1979, 20(6), 13-15.

Presents an estimate of the production figures and domestic consumption of leather footwears based on the total availability of raw materials as well as the export of various types of leathers which go in as inputs in footwear production. (CS)

- 88 DEB A et al : Lacquers based on cellulose esters for leather industry. Journal of the Indian Leather Technologists' Association, 1979, 27(7), 16-22.

The relative merits and demerits of lacquers based on different cellulose esters, general method of formulations, the functions of various constituents, their

advantages and disadvantages and the precautions necessary in formulation are discussed. A process worked out for lacquer manufacture based on cellulose acetate (secondary) and the properties of this lacquer, as compared to lacquer based on nitrocellulose on finished leather are dealt with. (AA)

- 89 DONOVAN R : Utilisation of tannery by-products. Leather Markets, 1979, 9(3), 19-27.

Reviews the present practice of handling the tannery by-products and presents different approaches to the same problem. (BS)

- 90 KUMARASWAMI N & CHELLAPA S : Role of Khadi and Village Industries Commission in the development of rural leather industry. Leather Processing, 1979, 3(2), 18-20.

- 91 MAHALINGAM N : The role of cottage industry in leather. Leather Processing, 1979, 2(12), 15-18.

Gives the estimated production and exports for the year 1983-84 of leather and leather goods for Tamil Nadu and the recommendations of the working group on leather and leather products. Also enumerates the recommendations on tanning, finished leather production, leather sports goods, leather goods, leather footwear and village leather goods, leather footwear and village leather industry in Tamil Nadu. (BS)

- 92 RAMAN K V : A review and scope on exports of leather and leather goods. Leathers, 1979, 20(7), 21-29.

Reviews the trends in the livestock population in India from 1951 and past and recent export trends in leather and leather products from India. (BS)

- 93 SAHA N N : Role of Indian Standards in the economics of leather industry. *Leathers*, 1979, 20(6), 25-30.

Discusses the role and efforts of ISI in the field of developing standards and specifications for leather industry. Gives also the list of Indian Standards available on leather, leather products and other related materials. (BS)

MINERAL BASED INDUSTRIES

- 94 ---- : Silver impregnated graphite contacts. *Chemical Industry News*, 1979, 24(7), 460-461.

Gives the profile of the product developed by National Physical Laboratory, New Delhi, which deals with the uses, demand, raw materials, equipment, process and economics. (BS)

- 95 BHAUMICK P K : Aspects of bloating fireclay refractories. *Refractories Journal*, 1979, (4), 26-28.

Essential features of the production technology, properties and uses of bloating fireclay refractories are described. Chemical and mineralogical aspects of the bloating phenomenon are discussed.

- 96 CHATTERJEE R N : Ceramics in electronic devices. *Indian Ceramics*, 1979, 21(12), 317-320.

Enumerates the application of ceramics as ferrites for electronic circuits and devices.

- 97 GRAY T J : Strontium glazes and pigments. *American Ceramic Society Bulletin*, 1979, 58(8), 768-770.

Gives the summary of some of the strontium glazes and their properties and discusses the preparation of the same. (BS)

ELECTRICAL INDUSTRIES

- 93 GUPTA S C : Shunt capacitors for varied load conditions. Electrical India, 1979, 19(11), 20-22.

Power factor correction is very essential. Shunt capacitors are used for this purpose. The ratings of capacitors to be incorporated are shown in different graphs. (LKPC)

- 99 NANDAGOPAL R : What to do when automatic voltage regulator fails? Maharashtra Sugar, 1979, 4(5), 29-30.

Factors to be observed and attended to at the time of automatic voltage regulator failure, are given. (MKSS)

ELECTRONICS INDUSTRIES

- 100 ---- : Electronic dust precipitator using corona discharge. Chemical Industry News, 1979, 24(7), 459-460.

Gives the profile of the product developed by National Physical Laboratory, New Delhi which deals with specifications, raw materials, equipment and economics. (BS)

- 101 BRAVN J et al : Parallel processing with mini-computers increase performance, availability. Electronics International, 1979, 52(14), 125-129.

Examines the various approaches to parallel processings such as single instruction - single data stream (SISD), multiple instruction-single data stream (MISD), single instruction-multiple data stream (SIMD) and MIMD, with particular attention to their applicability to mini computer systems. (VVR)

- 102 BRICKSON B K : TTL and C-MOS interface units microprocessor with calculator. Electronics International, 1979, 52(3), 132-133, 135.

Briefly explains a general-purpose scientific calculator (MOS technology's two-chip MCS 2525/2526) with block diagram. (VVR)

- 103 MARSHALL M : What to look for in logic timing analysers. Electronics International, 1979, 52(7), 109-114.

Discusses the logic timing analyzers of various types having more channels, assorted speeds, display options and novel triggering schemes to solve every digital timing problem. (VVR)

- 104 PENIMURI D et al : Surface-acoustic wave filters prove versatile in Vhf-applications. Electronics International, 1979, 52(14), 115-120.

Explains how photolithography mass produces surface acoustic wave (SAW) devices, and discusses several key applications of SAW technology in practice. (VVR)

- 105 WIDLAR R J : A new breed of linear ICs runs at 1-volt levels. Electronic International, 1979, 52(7), 115-119.

Discusses how the linear circuit design turns standard bipolar processing into micro-power technology. (VVR)

SENDOC SERVICES

Featured in this section are technical enquiries that were received and the services rendered by SENDOC during the month of January 1980. The charges for short technical enquiries will be Rs.5.00 to Rs.10.00 per typed page. Industry Profiles already available with SENDOC are charged at the rate of Rs.10.00 each.

S.No.	Enquirer	Service Rendered
1.	DIC, Karimnagar, Andhra Pradesh	Profile on: Cast iron foundry
2.	DIC, Rourkela, Bihar	78 Profiles on various industries: Engineering, Chemical, Electrical, Bicycle, Automobile, etc.
3.	DIC, Narsinghpur, Madhya Pradesh	Profiles on: Tyre retreading, Deter- gent powder, Miniature lamps, DC power supplies.
4.	DIC, Raipur, Madhya Pradesh	Profile on: Kraft paper
5.	Ent. Andhra Pradesh	Profiles on: Commercial growing of mushrooms, Printing inks, Reinforced cement spun pipes, Asbestos cement pipes, Aromatic perfumery chemicals.
6.	Ent. Bihar	Profiles on: Asbestos yarn, Dry batteries, Washing machine, Plastic articles of assorted varieties.
7.	Ent. Gujarat	Profile on: Auramine
8.	Ent. Maharashtra	Profiles on: Pulp mill, Steel - utensils, Pharmaceuticals unit, Jute twine.
9.	Ent. Rajasthan	Profiles on: Scented betelnuts

10. Ent. Tamil Nadu	Profiles on: Woven electric tapes, Mini rice mill, Metallic conduit pipes
11. IC. Bihar	Profiles on: Stainless steel utensils, Surgical instruments, Electrical accessories, Switches, Transistor, Induction - motors, FHP motors, Electric iron, Hot plates, Miniature lamps
12. IC. Rajasthan	Profiles on: Paper cones
13. SI. Andhra Pradesh	Profile on: Ice plant
14. SI. Bihar	Profile on: Spade
15. SI. Delhi	Profile on: Particle board from groundnut shell, Fluorescent lamp starter, Card board
16. SI. Madhya Pradesh	Profiles on: Ball point pen refills
17. SI. Maharashtra	Profiles on: Barbed wire, Low count yarn from cotton waste, Plaster of paris.

Note: DIC - District Industries Centre, Ent. - Entrepreneur,
IC - Industrial Consultant, SI - Small Industry

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NEW PRODUCTS AND PROCESSES

ELECTRONICS AND ELECTRICAL INDUSTRIES

Digital Grain Moisture Meter

The presence of moisture in grains poses a few problems for agriculturalists and grain dealers. Storage loss is high and storage life is low if the moisture content of the grain is high. Also the milling operation tends to be difficult and unsatisfactory if the moisture content is high. Hence the determination of moisture content is important to those engaged in production and distribution of grains.

To make moisture measurements possible, The Central Scientific Instruments Organisation (CSIO), Chandigarh has designed a special electronic device. A prototype of the device has been made and it has been found to work well.

The principle behind the design is that the grains have a dielectric constant, which is varying with the moisture content of the grains. The variation in the dielectric constant is used to vary the effective capacitance of a suitable capacitor assembly. By measuring this capacitance it is possible to indicate the moisture content of the grains.

The device is based on integrated circuits and the final readings of moisture are given on 3 digit LED display in terms of percentage. The device can measure over a range of 5% to 30%. An

automatic temperature compensating arrangement has also been included to make the measurements independent of variations in ambient temperature.

Broad Specifications

Range (Moisture content)	: 5% to 30%
Accuracy	: $\pm 0.25\% \pm 1$ digit
Display	: 3 digit LED

Since the product is assembly oriented, production equipments are not significant. However, for testing, the following are required; Oscilloscope, Oven, Analytical Balance, Power Supply, Oscillator, Frequency counter, LCR Bridge, Multimeter, Stabiliser and Variac. All are available indigenously.

ICs, LEDs, Transistors, Diodes, Zeners, Thermistors, Inductors, Resistors, Capacitors, Crystals, Transformers, PCBs, Chassis etc. are the components and raw materials required. All are indigenously available except ICs. The ICs can be directly imported or procured through ETDC. It may be noted that DC(SSI)/DOE approval is necessary, if direct import of raw materials is desired.

For manufacturing 300 meters per annum, the investment needed are:

	Rs.
Fixed capital (excluding land & building)	: 0.45 lakhs
Working capital	: 1.5 lakhs

Terms of Know-how: Lumpsum premium Rs 5,000/-; Recurring Royalty $2\frac{1}{2}\%$; Nature of licence Non-exclusive; Period of licence 5 years.

Digital Temperature Indicator

As its name implies, the digital temperature indicator gives out the temperature, measured by its sensors, in the form of numerals. This makes the measurements convenient, easy and accurate. The indicator has been developed at the Central Scientific Instruments Organisation (CSIO), Chandigarh. Three prototypes of the device have been made and they have been found to work satisfactorily.

The digital temperature indicator as developed by CSIO, can be used over a wide range of $- 200^{\circ}\text{C}$ to $+ 1760^{\circ}\text{C}$. Evidently a single sensor cannot serve the entire range and the CSIO design utilises four sensors as follows:-

- | | | |
|---|---|---|
| 1. Platinum-Platinum/Rhodium thermocouple | : | for $+ 200^{\circ}\text{C}$ to $+ 1760^{\circ}\text{C}$ |
| 2. Chromel-Alumel thermocouple | : | for $+ 10^{\circ}\text{C}$ to $+ 1200^{\circ}\text{C}$ |
| 3. RTD - 46 | : | for $- 200^{\circ}\text{C}$ to $+ 500^{\circ}\text{C}$ |
| 4. RTD - 100 | : | for $- 200^{\circ}\text{C}$ to $+ 650^{\circ}\text{C}$ |

The design of the instrument is based on IC technology and it is completely modular in nature. Each sensor is associated with a separate card so that replacement is easy. Any of the linearisation modules along with the common integral unit makes a complete digital temperature indicator, with the particular sensor. Depending on the requirement, a user may make his Indicator with one, two, three or four sensors.

Broad Specifications

Temperature Range	:	$- 200^{\circ}\text{C}$ to $+ 1760^{\circ}\text{C}$
Resolution	:	1°C
Accuracy	:	0.5% f.s.
Input Impedance	:	Greater than 2 M ohms
Display	:	$3\frac{1}{2}$ digit LED

The equipment required are: Oscilloscope, pulse generator, power supplies, stabiliser, avometer, variac, digital multimeter and digital LCR Meter. The last two are to be imported because of the high accuracy required, which is not available in indigenous instruments. The others are available indigenously.

Raw Material/components needed: ICs, LED display, Transistors, diodes, zeners, resistors, capacitors, potentiometers, transformers, PCBs, switches & other hardware items. All are available indigenously though ICs and LEDs are of imported origin.

For the manufacture of 300 Nos. of digital temperature indicators per annum, the following investment is needed:

Fixed capital (excluding land and building)	Rs 0.75 lakh
Working capital	Rs 1.5 lakh

Since the scheme involves the use of imported capital goods/raw materials, DC(SSII)/DOE approval is necessary for small scale industries.

Terms of know-how transfer: Lumpsum premium Rs 10,000/-; Recurring Royalty $2\frac{1}{2}\%$; Nature of Licence Non-exclusive; Period of licence 5 years.

TV Antennas - Multi-Channel

Band III TV antennas are used for TV reception on one or more channels (channels 5, 6, 7, 10 and 11) available at one place. They can also be used for point to point communication (transmission and reception). They are suitable for mobile communications too. Arrays of such antennas may be used for telemetry and tracking purposes.

With the planning of a nationwide TV hook-up, there will be considerable demand for band III TV antennas on different channels. The estimated demand by 1983 may be 2-4 lakh antennas/year.

TV antennas are vital components contributing to the satisfactory performance of the receiving set. These antennas consist of a driven element, at least one reflector and a number of directors. Except the driven element, all others are parasite elements and they assist in improving performance. Several parameters govern the overall-performance, such as length of the elements, spacing between the elements, length to diameter ratio, gradual taper in the length spacing, spacing between the two arms of the folded dipole and gap between the feed terminals of the folded dipole. The steps in the process of manufacture are: (a) marking and cutting the tubes, (b) drilling, (c) dipole bending, (d) assembly, (e) mechanical and electrical checking, and (f) quality control.

Specifications

Channels cut antenna

Channels 5, 6, 7, 10

Gain	4.5 - 7.5 dB
F/B	11-20 dB
VSWR	Better than 2.0
Input impedance	300 ohms balanced 75 ohms unbalanced

Multichannel antenna

Channels 5 to 7	Gain	6.3 - 6.6 dB
	E/B	15 dB
	VSWR	Better than 2.0

Channels 5 to 11	Gain	7.5 - 10.3 dB
	F/B	15-21 dB
	VSWR	Better than 2

Main raw materials: Commercial grade aluminium tube of 3/8 and 1/2 in diameter, aluminium section 1, 3/4 in.

Main equipment: Bench vice (4 in): pipe bending machine hydraulic (1/2 - 1/4 in); bench drill machine; portable drill machine; file set and workshop tools.

Predesign cost data (basis 15000 Nos. of varying Number of Elements)

Land and Building	Rented
Plant and Machinery including Furniture	Rs 0.35 lakh
Working capital	Rs 2.54 lakh
Cost of production	Rs 27-117, depending upon the number of elements

The technology has been developed at the Central Electronics Engineering Research Institute, Pilani on batch scale. A batch of ten antennas produced were put to field trials at Amritsar, Beas, Jullundur and Ludhiana and found satisfactory. The product conforms to IS specifications.

VHF Multichannel Electronic Tuner

In order to select different television programmes being broadcast at a given location and provide the possibility of selecting different channels available at different locations, multichannel T.V. tuners are incorporated in the T.V. receivers. There are various types of tuners viz. (1) Inductance ganged type (2) Coil insertion type (3) Turret type and (4) The Electronic

type, the last being the latest in series which has inherent advantage of higher reliability, compactness, ease of maintenance and flexibility in operation. The Central Electronic Engineering Research Institute (CEERI), Pilani has developed the design for electronic type tuners.

The electronic tuner usually contains three stages viz. (1) RF amplifier (2) Local oscillator and (3) Mixer. The signal received by the antenna is brought down to the input of the tuner. A filter to select Band I or Band III, is provided to minimise the interference. The Band selected signal is amplified by the R.F. Amplifier where the in-band channel selection is achieved by the varactor diodes used as the tuning elements. Switching diodes are used to select the required Band. The amplified signal is mixed with local oscillator whose frequency is also changed with the help of the varactor diodes and switching diodes. The mixed output is available at the standard Intermediate Frequency suitable for CCIR, Standard 'B'.

10 units of this tuner were made by the Institute and subjected to detailed tests and long duration field trials. Their performance has been found to be good.

Specifications

Type of tuner		Electronic
Supply voltage	:	12 V (regulated) Nominal
Gain	:	Band I - 30 db (min) Band III - 20 db (min)
Noise figure	:	Band I - 6.0 db Max. Band III - 6.5 db Max.
Intereference	:	I.F. rejection - Band I 40 db max. Band III 6.5 db max.

Type of tuner

Electronic

Image of rejection	:	Band I 50 db min
VSWR	:	Band I Band III
		without AGC 3 5 4
		with AGC 4.0 4

Transistors, varactors, switching diodes, VHF trimmers, feed through capacitors, coils, I.F. transformer and glass copper clad laminates are the electronic components/material required for manufacture of the T.V. tuner. The raw materials for the tuner box will be procured by the party contracted for this purpose.

Equipments required

Imported	VHF sweep generators, VHF detectors and Noise figure meter.
Indigenous	Oscilloscopes, Multimeters, Power supplies, VHF signal generator.

For the manufacture of 5000 Nos. of tuners per annum, the following investment is needed:-

Fixed capital (excluding land and building)	Rs 1.75 lakhs
Working capital	Rs 2.0 lakhs

Terms of know-how transfer: Lumpsum premium Rs 5,000/-;
Recurring royalty 3%; Nature of licence Non-exclusive; Period of licence 7 years.

FOOD AND ALLIED INDUSTRIES

Fish Meal from Trash Fish

The technology for the production of "fish meal" using trash fish and fishery wastes from fish processing industries, developed at the Regional Research Laboratory, Bhubaneswar can be conveniently

utilised in the cottage/small scale sectors in appropriate areas where the raw material is available at an economic price. The unit designed and worked at the laboratory can produce about 50 kg. fish meal per day from 250 kg. low grade fish. The process of production of fish meal consists in washing the raw fish, cutting into pieces, cooking, pressing the cooked meal and drying under continuous mixing over a heated sand bed. The dried material is powdered using a hand operated grinder. The items of equipment required for the unit are simple in design and can be fabricated using locally available materials. The main items required are: cooker, press, draining through, drying trays, heating trays, heating hearth and some miscellaneous equipment. The operations are easy and even an unskilled worker can be trained to operate the plant without any difficulty.

The feasibility report and process details are available from the Director, Regional Research Laboratory, Bhubaneswar 4 (Orissa). The process is operatable in 2 shifts of 8 hr/day, with 4 batches of 65 kg. each of raw fish. For reasons of economic viability, the cost of raw material is desired to be less than Rs 25 per quintal.

Garlic Powder

Garlic powder is used as a condiment in food preparations and as a carminative and gastric stimulant in medicinal preparations. As a condiment, it is used for flavouring mayonnaise and tomato ketchup or sauces, salad dressings, meat sausages, gravies, stews, spaghetti, chutnies, pickles, curried dishes, etc. It aids in digestion and absorption of food. For its anthelmintic and anti-septic properties it is used in a number of medicinal preparations.

The manufacture and marketing of garlic powder is a well established industry in USA and Europe. In India, though garlic is

grown abundantly and consumed as such, no efforts have so far been made to produce dehydrated garlic or garlic powder with the result that nearly 20% of the crop is wasted owing to respiration, transpiration and microbiological spoilage during storage. The conventional technique of making garlic powder consists in the removal of the outer papery skin of the garlic bulb and separation and peeling of cloves manually, dehydrating and powdering them before packing. This technique is tedious, labour and time consuming and hence costly. The Central Food Technological Research Institute (CFTRI), Mysore, has developed an improved process for the production of dehydrated garlic powder free from husk. In the CFTRI process garlic bulbs are broken and the cloves and the papery husk are separated by aspiration. The cloves are mechanically pre-conditioned and dried. The dried material is passed through a pulper to separate the thick adhering husk from the meat. This mixture is pneumatically separated and the dried meat is powdered to obtain the product.

The process has been investigated in the laboratory on a 10 kg. batch scale. A pilot plant having a capacity of 10 kg/day has also been set up and operated. The product obtained conforms to IS specifications.

Flaking rolls, through-flow drier (two in number with trays, temperature range 60-80°C), pulper with nylon brushes, air classifier hammer mill, vessels and trays for handling materials are the equipment needed. All these are available indigenously.

The capacity of an economically viable commercial plant as suggested by CFTRI is 225 kg. of garlic powder per day (or 750 kg. of garlic bulbs per day). The land required for a unit of this capacity is 2400 sq.ft. for plant and building and another 2400 sq.ft. for storage of raw materials and finished products. The

total investment required for the plant is Rs 2.5 lakh (excluding the cost of land and building). The cost of production of garlic powder has been estimated at Rs 15,000/- per tonne.

Papain (IP) and Papain Concentrate

Papain (IP) has a variety of uses. In the pharmaceutical industry it is used for the production of protein hydrolysates, lactopeptones, etc., in the food industry as a clarifying agent for juices, beer, etc. in textiles for degumming and in leather industry for tanning. Papain concentrate finds use in food and pharmaceutical industry where a high purity, colourless and odourless product is required.

Papain (IP) has a high indigenous demand as well as export potential. At present, its production is very limited. The demand for papain concentrate is met entirely through imports, mainly from USA. The requirement of papain (IP) by 1983-84 has been estimated around 120 tonnes. The present market prices of the two products are: Papain (IP), Rs 150/kg. and papain concentrate, Rs 800/kg.

Papaya latex, immediately after collection is mixed with potassium metabisulphite (KMS) and stored at 0-10°C till it is processed. The latex is sieved (40 mesh), mixed with a cation exchange resin and blended. The mixture is centrifuged to separate the resin and liquified latex. The liquified latex is vacuum dried at 50°C. The dried powder thus obtained is sieved, tested for its proteolytic activity and diluted with lactose powder to get papain. (IP).

To obtain papain concentrate, supernatant liquid of the papaya latex, processed as above, is subjected to pressure filtration

followed by treatment with denatured spirit. The resulting slurry is filtered under air pressure till semi-dry, ground and completely dried in vacuum. Potassium metabisulphite (KMS) is added.

Raw materials are: Papaya latex, potassium metabisulphite, lactose powder, sodium hydroxide, hydrochloric acid, zeokarb 225 resin and De-acidite FF resin. All the materials are available indigenously.

Main equipment: For papain (IP): ribbon blender, vacuum shelf-drier, basket centrifuge, grinder, and resin columns. For papain concentrate: additional items of equipment required are pressure filter with air compressor, vacuum shelf-drier, SS tanks, steam boiler, and alcohol distillation plant.

Predesign cost data (basis papain IP: 90 TPA; papain concentrate: 1.8 TPA)

Land and building	Rs 1.90 lakh
Plant and machinery	Rs 5.95 lakh
Working capital	Rs 8.10 lakh

Cost of Production:

(a) Papain (IP)	Rs 89.65/kg
(b) Papain concentrate	Rs 429.40/kg.

Investigations were carried out in the Central Food Technological Research Institute, Mysore on production scale of 30 kg. IP grade papain and 6 kg. papain concentrate per day. Samples of products have been assessed with respect to their quality compared to standard specifications. The know-how developed is suitable for commercialization by small scale entrepreneurs in rural areas where the raw material, namely papaya, may be available or can be conveniently cultivated.

MINERAL BASED INDUSTRIES

Carbon Refractories

The carbon refractories find application in different areas of iron & steel industry for such properties as non-wettability, volume stability etc. These refractories are being imported at present. The properties of carbon blocks developed are given below:-

1.	App. porosity (%)	18-21
2.	Bulk density (gm 'cc)	1.5-1.62
3.	Cold crushing strength (kg/cm ²)	350-472
4.	Modulus of rupture (kg/cm ²)	85-113
5.	Carbon content (%)	94-98
6.	Ash content (%)	2-6

It is estimated that the consumption of carbon refractories is of the order of 2,000-3,000 tonnes per annum which is likely to increase further.

Selected variety of petroleum coke which is indigenously available, is crushed and graded into different size fractions with the idea of attaining a maximum dense aggregate of coke particles. Preheated coke particles are intimately mixed with the molten tarry bond, the mixed mass is moulded to the desired shape and size by application of pressure or by ramming. The body duly compacted in a shape is fired to temperatures above 1000°C under strictly controlled conditions. The product has already been tested for this purpose at Rourkela Steel Plant.

The investigation was carried out in 3 stages at the Central Glass & Ceramic Research Institute, Calcutta 1. Laboratory bench

type slab 225 x 112 x (25-40) ■■, 2. Full bricks 225 x 112 x (75-77) ■■. 3. LD converter blocks - 350 x (200-165) x 190 ■■.

Investigations were carried out on samples made on laboratory scale in the form of standard bricks and larger blocks weighing up to 25 kgs. These have been evaluated both at the institute and the Rourkela steel plant for their performance.

All the raw materials are indigenously available; 1. Indigenous-Calcined petroleum coke, pitch and tar etc., 2. Imported: Nil.

Machinery & Equipment: Electric drier; Bond melting oven, Hot mixer, Air compressors and rammers, Moulds, Device for heating mould, Device for cooling the moulded product, Device for material transfer, Safety measures, Muffling arrangement inside the kiln.

Other equipment include machines for crushing, grinding, sieving, weighing etc., also firing facilities should be made available in existing plant.

For the suggested economic unit of 200 tonnes per annum, the capital investment is as follows:

1. Fixed capital on building	Rs 51,000/-
2. Fixed capital on plant	Rs 2.70 lakhs
3. Working capital	Rs 4 lakhs
4. Total capital required	Rs 7.21 lakhs

Essentially this process can be taken up by manufacturers who are already familiar and are having facilities of making refractories.

Ceramic Colours

The Glass & Ceramic Research Institute (CGCRI), Calcutta has developed about two dozen ceramic colours (overglaze and underglaze) covering the principal shades usually used in ceramic industry. The ceramic colours and stains have found wide application in the pottery and enamel industry.

The products of the process consist of (a) ceramic and enamel stains (b) overglaze and underglaze ceramic colours and (c) overglaze transfer printing colours. These colours are used to make the products decorative and attractive with colourful finish and also for producing ceramic transfers. The stains (pigments) which form essential ingredient of ceramic colours can also be used by the enamel and pottery industries for making coloured enamels, coloured pottery bodies, glazes etc.

The demand of these products is estimated at about Rs 20 lakhs per annum and their substantial amount is still being imported.

The know-how of the process has been developed on a semi commercial scale at the Institute. The process consists of three steps: i) producing the ceramic/enamel stains (pigments) by calcining the batch in oil or electric heated furnace in the temperature ranges of 1000°C-1300°C followed by washing and fine grinding; ii) producing the overglaze and underglaze fluxes by smelting or calcining the batch in oil or electric heated furnace in the temperature ranges of 1000°-1200°C; iii) producing the ceramic overglaze, underglaze and transfer printing colours by mixing the stains (pigments) with overglaze or underglaze fluxes by wet grinding (-300 mesh).

No specifications are available but the products have been tested for colour stability and also to suit various end use requirements.

Commercial grade raw materials commonly used by the ceramic industry are required and most of them are indigenously available. Some of the colouring agents like cobalt oxide, cadmium salts etc. are imported items but these are easily available in the country.

Equipment: i) Oil fired crucible furnace, ii) sieving and mixing accessories iii) weighing balance etc. All are indigenously available. Suggested optimum plant capacity: 50 kgs per day in one shift (8 hours).

The fixed capital on plant and equipment is estimated at Rs 1.70 lakhs and a working capital of Rs 3.0 lakhs (for 90 days) is required. Testing laboratories for checking the qualities of raw materials and testing of the reproducibility of the colouring shades maturing temperatures of the colour and chemical resistance etc. will be needed.

Safety consideration: Precautions should be taken against lead poisoning.

Fibre Glass

Modern technology for manufacture of reinforcement fibre is highly capital intensive and the future trends are towards further sophistication to achieve faster production. Contrary to this, a simple indigenous technology, specially suited to the small scale sector has been developed for manufacture of reinforcement fibres in the form of rovings, chopped strands and woven mat using commercially available neutral glass rods as the starting material. A full-scale module has been set up at the Central Glass & Ceramics Research Institute, Calcutta which can produce about 2 kg. of fibre glass per hour.

FRP Composite specimens were prepared using these fibres and polyester resin and tested at the Institute and also at the Vikram Sarabhai Space Centre. The results show that the strength of the specimens compare favourably with these prepared from commercial chopped strand mat under indential conditions.

The smallest viable unit would produce 100 kg. fibres a day (in three shifts) with an investment of about 1.5 lakh in machinery and equipment. Such an unit can be set up by FRP manufacturers as a captive facility for supply of fibres. The estimated cost of production in 400 kg. unit is about Rs 16/- per kg. which is less than half the prevailing market price.

The raw materials required are: Glass rods, sizing agent & coupling agent, and softener. The investment on plant and equipment, erection and installation etc. is estimated at Rs 6.17 lakhs and a working capital of Rs 4.38 lakhs (for 3 months) is required.

Mini Cement Plant

In order to ensure effective transfer of mini cement plant technology developed by the Regional Research Laboratory, Jorhat, National Research Development Corporation of India, FACT Engineering & Design Organisation (FEDO) - a division of the Fertiliser and Chemicals, Travancore Ltd. and Regional Research Laboratory, Jorhat of CSIR have come to an agreement to assume joint responsibility.

As cement is a very sensitive area and the mini cement plant i.e. the Vertical Shaft Kiln plant is almost a novel feature in the cement industry in India and other developing countries, the RRL authorities decided after weighing all the pros and cons to

join hands with a reputed, experienced and equipped engineering firm like FEDO. Although the V.S.K. plant developed at RRLJ has already been licensed to a firm at Kutch Gujarat on 'as is where is' basis and the Gujarat plant is going to be on stream within a short time, RRL felt that it would be good for all concerned if the mini cement plant technology could be offered on a turnkey basis with total technical guidance. This joint offer would reduce considerably the normal 'aches of pains' of the entrepreneurs inherent in such type of industrial ventures.

As per the concluded agreement, the Laboratory would transfer to FEDO complete process know-how information including detailed design for Vertical Shaft Kiln section of a 30 TPD mini cement plant. The basic guarantees for process and production would be provided to FEDO to enable them to offer following turnkey guarantees to the entrepreneurs intending to set up integrated mini cement plants consisting of raw materials, pre-processing, shaft kiln and clinker grinding sections.

- i. Technical adequacy of the engineering design
- ii. Performance of the integrated process
- iii. Quality of the product, capacity for production and consumption of raw materials and utilities.

Based on the design information made available by the Laboratory, FEDO would prepare a detailed engineering package for an integrated mini cement plant of 100 TPD capacity. NRDC is agreeable to advance a sum Rs 2.5 lakhs for the preparation of the first detailed engineering package.

The tripartite agreement thus enable FEDO to undertake turnkey assignments for setting up mini cement plants in the country.

NEW MACHINERY AND EQUIPMENT

CHEMICAL PROCESS EQUIPMENT

Asphalt Hot-Mix Plant and Paver Finisher

Apollo asphalt hot-mix plant model 30/45 is mobile/stationary, batch/continuous type. It is electric diesel driven and has all the drives through reduction gear units. The plant comprises of four units: viz. feeder for material feeding, drying unit, mixing unit and bitumen tank of adequate capacity. The feeder may be of the gravity type, belt conveyor type, or reciprocating type to suit requirement. The drying unit, the mixing unit and the bitumen tank are mounted separately on a heavy duty steel frame supported by pipes. A bucket elevator is used for feeding the cold aggregates by means of an elevator chain into dryer. The dryer shell is of rotary drum type fabricated out of boiler steel plates having alloy steel-buckets to lift the aggregates for efficient transfer of heat. An exhauster is fitted to draw off vapour, gases and dust from the dryer through the cyclone dust collector. A blower is provided to supply the high volume air to the burner for firing the preheated furnace oil. An elevator is provided to lift the dried heated aggregate from the dryer and is carried to the pug-mill is of twin shaft paddle type fitted with extremely hard casted alloy paddle arms. All controls are grouped at the control panel so that an operator can easily and efficiently handle the plant.

Apollo Paver Finisher is designed to lay an excellent mat of

bituminous mix up to a meter wide and 20 ■ thick. Width of the mat can be varied between 2.5 meters to 4.0 meters in increments of 7.5 ■. It is powered by Perkins 4 (I) diesel engine with the battery starting arrangement. It is mounted on two pneumatic tyres at the rear. Front wheels are fitted with an automotive type steering and the main drive is through the differential drive. Power operated brakes are provided on each side. Two push rollers are properly spaced to contact the rear wheels of the material feeding truck. The floor of the feeding hopper is constructed of abrasion resistant steel plates. The conveyor chain moves the material to the spreading auger made of heat treated abrasion resistant alloy steel. Paver Finisher is equipped with tamping device for the compaction of the mat laid at the rate of 1000 strokes per minute. Floating screen is adjustable to give a crown to the compacted mat and is hydraulically raised and lowered. Maximum travelling speed is 16 KMPH. All the controls are grouped at the left rear to the Paver Finisher within easy reach of the operator.

Further details from: Apollo Industrial Products (P) Ltd., Highway, Mehsana-384002.

Flow Meters for Oil, Chemical and Feed Industries

An accurate volumetric control of industrial liquids is an economic necessity in view of the high value of these products. The design and material of volumetric meters must be adapted to the particular operating conditions and the properties of these liquids. Positive displacement flow meters manufactured by M/s Oval Engineering Co. Limited, Japan, are used for a multitude of metering and control purposes, in the mineral oil industry for the loading of tankers and tank trucks, in the chemical industries for

measuring costly and corrosive liquids, in the food industry for measuring milk, vegetable oils, fruit juices, spirits, beer and other liquid products.

These meters incorporate a set of oval-shaped gears mounted on horizontal shafts which are rotated by a slight pressure difference. The liquid flowing through these meters are measured continuously by a crescent shaped let-through gap. The volume of the crescent shaped gap, formed between the oval geared rotors and the metered body, is pre-determined. Thus the number of rotation is directly proportional to the measured volume, and the rate of flow by the speed of revolution of the rotors. The meshed teeth of the rotors prevent any slippage and hence these meters are exceptionally accurate.

The salient features of the meters are absolute simplicity of design, exceptionally high guaranteed accuracy, low maintenance and longtime. These meters are unaffected by changes in density, viscosity and lubricity of the metered liquid. A large range of accessories are available for this meter type: for example, mechanical, pneumatic, electric, and electronic data transmitters, giving digital and analog values for remote control, flow rate indication and control, computer input and data loggers as well as automatic batch control for different types of shut-off values.

Specifications

Flow range	: 10-360 lts/hr to 50-100m ³ /hr
Meter size	: 15 kinds (within the above flow range)
Flange connection	: 10-340 ■
Materials	: Liquid contact portion: Copper alloy, cast iron, stainless steel. Outer housing: Copper alloy, cast iron, stainless steel, or OZ

	: Ductile cast iron or cast steel
Accuracy	: Less than + 0.5%
	Less than + 0.2% (on request)

Further details from: IAEC (Bombay) Ltd., 196, L.B. Shastri Marg, Bhandup, Bombay-400 078.

Flow Seal Butterfly Valve

Flow-Control Butterfly Valve features inclined seat which reportedly eliminates the problem of conventional vertical and offset disc butterfly valves. Special method of connection of the shaft to the disc prevents disc flutter. Angle construction gives 360° uninterrupted contact of disc and seat. The plane of the seat being at an angle to the axis of rotation, the disc engages from the seat immediately on a slight opening of the valve. This results in a long life for the flapper seal. The valves are available in sizes ranging from 50 to 800 MM and in three models. The M series has pressure energised seal on the flapper, which is easily replaceable. All series have replaceable set with rings, the R series have rubber lined seal rings. The replaceable seat ring is such that the outer body does not come into contact with the corrosive media, thus necessitating the use of expensive and sophisticated corrosion-resistant alloys for the wetted parts only. The flow is linear and directly proportional between 10° and 80° opening. Wafer design eliminates the need for gaskets. Seals and their placings are made according to BS 1806. Applications range from water works to chemical industries including thermal power stations. The valves can also be specially built for high temperature service. It can be available with lever, chain wheel, electrical, pneumatic and other actuators.

For further details contact: Flow Control Engineers, 508, Marine Chambers, 11, New Marine Lines, Bombay-400 020.

Process Control Simulator

A simulator for teaching instrument mechanics and refinery process operators, the principles of process control engineering in the petroleum and chemical industries has been introduced by Plint & Partners of the UK.

In modular form, the simulator closely resembles the layout of a real process plant. An operator's control station and instructor's console are separated from the miniaturized process plant so that the trainee may gain confidence in dealing with faults in actual working conditions.

The miniature process plant comprises vessels and pipework enabling water to be transferred under controlled flow conditions at pressures of up to 400 kPa (4 bar or 50 lbf/sq in) and temperatures of up to 100°C. Air leaks and faults can be introduced into the circuit from the instructor's panel. The operator control unit incorporates standard temperature and level controllers and recorders as used in most process industries. It allows the process operator to study the construction, method of operation and use of the standard types of transmitter, recorder controller and control valves.

An operator can observe the operation of control loops of various kinds, including those used in cascade. He gains experience in bringing a system on stream and in dealing with various faults that may arise in the operation of process plant.

For further details please contact: Plint & Partners Ltd., Fishponds Rd, Wokingham, Berks RG11 2QC, U.K.

ELECTRONICS AND ELECTRICAL EQUIPMENT

Auto-Solder Coater (ASC) for Printed Circuit Boards

A low-cost fully automatic hot dip solder coating machine for printed circuit boards (PCBs), has been developed by the Indian Space Research Organisation, Bangalore. The machine is under extended test and evaluation.

Hot-dip solder coating, which dispenses with chemicals, is by far the best method of solder coating ensuring excellent solderability and prolonged shelf-life of the PCBs.

The ASC developed by ISRO performs 10 operations automatically in a sequence by a single command, to a programmed electrical switching circuit, also designed by ISRO. Manual over-ride during auto-operations is also possible. The equipment has a mechanism to dip the printed circuit board into a molten solder both to sling off the excess solder and to shake clear the component holes and eyelets of the PCB. Approximately 30 kg. of solder is required as the initial charge for getting optimum results. Parameters like dwell time of the card in the solder bath, spin time, speed of rotation of the card, and the solder bath temperature are all adjustable individually. Normally the thickness of the solder coat is in the range of 10-20 microns. Approximately 30 PCBs of sizes up to 270 ■.sq. (of single side/double side) can be coated in 1 hr. The system operates on 3-phase 400 V. 50Hz power supply and does not require pneumatic or hydraulic auxiliary systems.

Fraction Collector

A fraction collector, a sophisticated instrument for dispensing liquid samples of equal volumes in a large number of containers and which finds application in Bio-medical and Analytical

laboratories, has been developed in the School of Automation at the Indian Institute of Science, Bangalore.

This instrument, which is small in size, is based on the latest available digital technology, which offers high reliability and accuracy. The choice of 'drop mode', where the fluid drops are sensed by a photoelectric device coupled to an electronic counter (range: 1-999 drops), or 'time mode', where a time generator is used for pulsing at the rate of 0.1 minute (range: 0.1 - 99.9 minutes) is made available. One complete mechanical movement of the dropper head scans 10 rows each of 10 test tubes.

Materials for the moving parts of the system are selected with a view to maintaining accuracy and reliability, even under cold room conditions. This unit has been built using components readily available in the country.

Thermocouple Attachment Unit

Advani-Oerlikon have now made it possible to correctly measure temperatures during postweld heat treatments of welded fabrications. The Company has introduced a thermocouple attachment unit (TAU) which provides an ideal method of attaching thermocouples to weldments. Conventional methods used for thermocouple attachment are such that they give inaccurate temperature readings on the temperature recorder. In fact the temperature indicated is not truly of the weldment being heat treated. As a result, errors ranging upto 50°C are common. However, with Advani-Oerlikon's TAU, such errors will now be eliminated.

The thermocouple attachment unit consists of a battery which is chargeable from 230 volts AC supply. This battery supplies the power to flash butt weld the ends of thermocouple wire directly on

to the surface of the weldments. The wires are spaced approximately 6 ■ apart. The "junction" of the thermocouple becomes the weldment itself. Thus there can be no inaccuracy in the temperature measurement. Elements and heaters can over-ride the thermocouple "junction" and also the thermocouple as it leaves the junction area.

Advani-Oerlikon's TAU is a portable unit, weighing only about 5 kgs. It operates on the capacitor discharge system. The output circuit consists of a solid state diode, thyristor circuit for accurately discharging the capacity energy. The unit is extremely simple to operate. A minimum of 300 ■ long twisted - pair thermocouple wire, having 10 ■ asbestos sleeves pared off at the ends, can be flashed on to the weldments. All you have to do is grip one of the wires with the pliers and hold it against the pipe where the junction is desired. The end of the pliers is connected to the thermocouple attachment unit. In other words, the pliers act as an applicator. Press the charge button until the button shows "charged". When in position, depress the button which allows the current to flow through the wire and make the miniature spot weld. Repeat the exercise on the wire, holding it to the pipe surface 4 to 6 ■ away from the first wire. Approximately 200 flashes can be obtained before the battery needs recharging.

Advantages: (a) No preheating is required for welding ferrules on alloy steel pipes. (b) No grinding is required. (c) With correct temperature measurement and control, accurate Brinnel hardness values can be obtained.

For further enquiries write to: Advani-Oerlikon Limited,
Dr Shrodkar Road, Parel, Bombay 400 012.

Tool for Changing Fluorescent Tubes and Light Bulbs from a Distance

Changing light bulbs and fluorescent tubes in factories or other high rooms has hitherto been not only a time-consuming task but often also a dangerous one if there are steel structures in the roof of the building or obstacles on the floor. It has not been unusual for this operation to involve risky climbing.

In order to enable such operations to be carried out more efficiently and safely a Dutch Company is now manufacturing a tool with which virtually all the light bulbs and fluorescent tubes on the market and their starters can be changed from the ground up to a height of 6 metres.

The tool consists of a telescopic shaft, the sections of which can be easily fixed in position, after being pulled out to the desired length, by a simple twisting movement. At the top of the shaft there is an adjustable ball joint with a knurled nut for fixing the actual claw section.

There are three interchangeable claw heads namely:-

1. a claw for fluorescent tubes. This works basically by grasping and twisting the tube using a number of elastic rubber bands arranged in a V shape. These bands can be twisted by means of a handle or knob at the bottom of the telescopic shaft.
2. a starter claw. This consists basically of a rubber holder which is pressed around the cylindrical starter. Installation or removal is also carried out by twisting the handle at the bottom of the telescopic shaft.

3. a claw or bulb holder for normal light bulbs. This uses a very flexible suction cap which automatically adjusts to virtually any known bulb shape. Here again the vacuum for the suction and for fitting the rubber cap around spherical part of the light bulb is obtained by twisting the handle at the bottom of the telescopic shaft.

It has been calculated that changing bulbs in the manner described above can be carried out six times as quickly as by conventional methods.

The tool is marketed as the 'Gesco TL Boy'. Patent application have been granted in several countries.

For details contact: Midden Brabant B.V., P.O. Box 6, Hapert (Holland).

ENGINEERING EQUIPMENT

Centreless Bar Turner

A recent addition to the range of steel bar finishing machinery produced by Cenbar Tools Ltd., is the centreless bar turner, which has a turning capacity from 19 mm. to 64 mm. dia. Known as Cenbar model 065, it is said to be capable of high rates of machined bar output and can be readily incorporated in a combined bar turning and reeling system. Bar peeling and finish turning can be undertaken, and the machine is offered with a choice of index-type cutter heads to suit user requirements.

The headstock is powered by a mechanical variator and toothed

belt drive system which provides a steplessly variable range of speeds at the cutter head spindle. The spindle assembly is designed to absorb initial shock loading during bar entry, while provision is made also for effective support of bar material in the cutting zone. A specially designed water tube system has been incorporated in the spindle assembly to ensure an adequate supply of coolant to cutter head tooling.

Once operational set-up is completed, the centreless turning process is automatic and continuous. Hot-rolled bars are delivered single from an input stillage to a roller track which conveys them to the feed roll unit. This unit is capable of feeding bars, end to end, through the rotating cutter head at throughput rates steplessly variable from 1.5 to 10.5 m. per min. Machined bars emerging from the cutter headstock are controlled by a gripping carriage which traverses along guideways to transfer the material to the turned-bar stillage.

Standard bar length capacity is from 1.5 to 6 m., although handling systems can be arranged for longer bar requirements.

Inquiries to: Cenbar Tools Ltd., Taylor Industrial Estate, Risley, Warrington WA3 6BL, U.K.

Grease Life Tester for Roller Bearings

The Government Mechanical Engineering Laboratory of the Agency of Industrial Science and Technology, Japan, has developed a roller bearing grease life tester for use in testing the life of grease in roller bearings.

The tester is composed of a rotary shaft connected to a motor, a grease test bearing connected with the shaft, and holding bearings for holding the shaft. When testing the life of grease, a grease

test bearing load (radial load) is applied to the testing bearing before the bearing is placed in the heating chamber. Each of the inner and outer rings of the test bearing is provided with a thermistor to check temperature changes in both rings at all times, and this is the main feature of the tester.

Tests conducted show that (1) there is a considerable change in the temperature of the inner and outer rings and, accordingly, a discernible change in the life of grease, depending on the number of rotations of the shaft and the load, and (2) there is also a change in the life of grease, depending on the type of the test bearing, i.e., pressed-cage type or drilled-cage type. Data in respect of relationship between temperature changes in the inner and outer rings of a bearing and the life of grease are being collected so that the life of grease can be measured with minimum scatter in measured values. Initial results show that the drilled-cage type bearing is superior to the pressed-cage type bearing in reducing the extent of scatter when measuring the life of grease. Consequently, the former will be used for the present. In future, however, other types of bearings will be used for testing purposes.

Hardness Testers: Portable Models

Two portable hardness testers, the Wilson models M51 and M52 now available from Rockwell Hardness Testers Ltd., are said to be well suited for the production testing of crankshafts, cylinder blocks, assemblies and similar pieces. They have the advantage of being able to be used at any angle without affecting accuracy.

In use, the unit is simply clamped on to the specimen to be checked, the minor load is applied and the pointer set before continuing to apply further loading until the major load is reached. The device is then returned to the set point when the hardness value

can be read off directly.

The model M51 has a 114 mm. thickness capacity, a throat depth of 57 mm. and weighs $3\frac{1}{2}$ lb., while the model M52 has a 305 mm thickness capacity, a throat depth of 152 mm. and a weight of $10\frac{1}{2}$ lb.

Inquiries to: Rockwell Hardness Testers Ltd., Sandy Lane, Stourport-on-Severn, Worcs., U.K.

Roundness Tester: Multi-purpose Model

An instrument for roundness testing, which is said to be suitable for shop floor use, is now being offered by C.E. Johnasson Ltd. Based on the proven CEJ Roundness Tester with its air bearing table, high precision spindle and capacity for workpieces weighing up to 50 kg. this latest version has an integral micro-computer and polar recorder which provide for detailed analysis of roundness, squareness, flatness, parallelism and skew.

Turntable accuracy is quoted as being ± 0.001 mm. and automatic centering eliminates the time consuming setting-up stage. Magnifications from 50 to 10,000 times are provided, and direct digital display of peak to valley height is given, together with the offset of the true centre from that of the least squares circle. The angular position of this offset can also be displayed.

For hollow cylindrical objects, where internal and external diameters are being checked, the least squares circle can be superimposed on the inner and outer graphs to show concentricity, and a new feature is the true scale picture of the inner profile centre. All the facilities for checking skew, alignment of centres, and full three-plane analysis of configuration are provided by the micro-computer.

Inquiries to: C.E. Johanson Ltd., 66 High Street, Houghton
Regis, Dunstable, Beds, LU5 5BJ, U.K.

INDUSTRY ROUNDUP

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

CAUSTIC SODA INDUSTRY IN INDIA

1 Introduction

The production of caustic soda dates back to the middle of the 18th century. It was manufactured for the first time, on a commercial scale in 1853 by LeBlance soda makers by causticization of lime.



The calcium carbonate produced is almost insoluble in water. Electrolytic production of caustic soda was known in the 18th century, but it was only in 1890 that caustic soda was produced for industrial use. It was not until 1940 however, that the electrolytic process took a rapid spurt and in 1946 it overtook the chemical process substantially. By 1962 the causticization process was almost completely replaced by electrolytic process.

The caustic soda/chlorine industry is one of the oldest - almost 40 years - in the field of chemicals in India. These are very important chemicals with a wide range of uses. Caustic soda is used in manufacture of rayon staple fibre, filament yarn, tyre

cord, paper and pulp, aluminium, petroleum refining, textiles, soaps, vanaspathi, drugs, dyes etc.

Chlorine is a basic raw material for PVC, paper, DDT and other pesticides, stable bleaching powder, benzene hexachloride, chloromethane, ammonium and aluminium chlorides, dyestuff and pharmaceuticals intermediates, basic organic chemicals, water treatment etc.

The caustic soda/chlorine industry started in India in 1941 with the commissioning of two units, one each at Calcutta and Mettur. Even though the industry is young in India, its growth has been spectacular, specially during the sixties. While production in 1951 was barely 16,000 tonnes, it rose to 93,000 tonnes in 1960. Thereafter, the demand for caustic soda increased rapidly - a steady average growth rate of about 14.6% during the sixties, due to the fast growth of various consuming industries within the country. There has also been the emergence of many new consuming industries during the last three decades.

Besides the growth in the consuming industries, other factors which have helped the growth of this industry are the shift in technology all over the world from diaphragm to mercury cells and the higher gainful utilisation of chlorine produced. Whereas the first two caustic units started with diaphragm cells, today 77% of country's caustic soda is based on mercury cells. The shift in technology started in 1951, when the first mercury cell based plant was commissioned. Due to the advantages of product purity, as required by some of the consuming industries, such as, viscose rayon, the trend for all new units in subsequent years has been to adopt the mercury cell process. Besides, with the changeover from diaphragm cells to mercury cells, the average plant capacity increased from about 20 tons/day in fifties to the present 50 tons/day. Efforts are being made now to raise this level to 100 tons/day

so as to make the units more viable and to meet the advantages of economy of scale.

The second factor, viz. chlorine utilisation efficiency, has always been of paramount importance in the growth of the caustic soda industry. The Government has taken this point into consideration while licensing additional capacities. This is mainly because, while the production of caustic soda boomed during the sixties, the corresponding avenues for chlorine utilisation were hard to find. However, due to the rapid growth of major consuming industries such as DDT, bleaching powder, PVC etc. chlorine utilisation efficiency has improved considerably; from a national average utilisation figure of 63 to 65% in 1967, it rose to about 79% in 1970.

2. Uses

Caustic soda is widely used in the field of soaps, detergents and petroleum refining. But during the last two decades it has found usage in other industries like pulp and paper, rayon and cellophane, cleanser etc.

a) Pulp & Paper Industry

The pulp and paper industry requires large quantities of caustic soda and chlorine for bleaching of the pulp and removal of lignin, hemicellulose and colour bodies to make it suitable for paper making.

b) Manufacture of Soap

Caustic soda has been widely used in the manufacture of soap and detergents as it has very good cleansing properties.

c) Textile Industry

Caustic soda is used in the textile industry for mercirization of cotton. When caustic soda is applied to cotton and then washed out while the cloth is uunder tension, the crystalline orientation of the fibre is changed. This improves the lustre, greater strength, better dyeability and in some cases greater dimensional stability.

d) Petroleum Refining

Caustic soda is used to remove sulphur compounds like H_2S and mercaptans in the refining of petroleum.

e) Food Processing

Caustic soda is used to peel fruits and vegetables, to process olives and to refine vegetable oil.

f) Rayon Manufacture

Caustic soda is very important chemical for making viscose and suprammonium rayon.

3. Present Position

a) Capacity & Production

Production of caustic soda during the calendar year 1978 was 5.50 lakh tonnes - an increase of 37,000 tonnes over that in 1977. Addition to installed capacity during 1978 totalled 53,400 tonnes, through the commissioning of the unit of Kothari (Madras) Limited and expansions in the units of Atual Products, Calico Chemicals, Bombay and DCM Chemical Works. The total installed capacity at the end of the year stood at 7,82,400 tonnes.

3. Caustic Soda Capacity as on 1st January 1979 and Production during past Three Years:

Name of unit	Installed capacity as on 1.1.79 MT	Actual Production in			
		1976 MT	1977 MT	1978 MT	1979 MT Jan/Mar
1	2	3	4	5	6
MERCURY PROCESS					
- Andhra Sugars	33,000	21,000	21,000	23,000	6,750
- Ashok Paper	7,700	-	450	2,250	350
- Atual Products	16,900	6,250	5,700	5,500	1,750
- Ballarpur Ind. Karwar	33,000	21,350	21,900	22,900	7,650
- Calico, Bombay	32,200	23,900	23,350	24,100	6,400
- Century Chemicals	16,500	18,050	17,200	18,100	4,600
- Dhrangadhra Chemicals	49,500	37,700	33,900	41,800	9,800
- Gujarat Akalies	37,400	2,800	25,050	38,000	12,150
- Gwalior Rayons	41,300	46,550	44,500	39,800	10,750
- Hukumchand Jute	22,700	20,050	18,900	16,550	4,500
- Jayashree Chemicals	16,500	18,550	18,400	18,450	4,450
- Kanonia Chemicals	33,000	24,250	22,250	23,950	5,850
- Kathari (Madras)	33,000	-	-	250	2,300
- Mettur Chemicals	42,900	20,500	26,105	35,400	8,750
- National Rayon Corpn.	31,400	23,700	18,200	20,600	5,600
- Sriram Chemicals	42,900	31,900	29,850	27,500	7,000
- Standard Alkali	77,600	37,650	46,250	52,300	14,650
- Travancore Cochin Chemicals	59,400	28,900	28,700	24,000	7,750
- Durgapur Chemicals	10,050	4,600	2,750	1,950	500
- Hindustan Heavy Chemicals	5,500	5,100	5,300	5,350	1,350
- J.K. Chemicals	2,500	200	500	850	200
- Nepa Mills	3,700	3,850	3,550	2,850	650

	1	2	3	4	5	6
- Orient Paper Mills	3,200	2,850	3,100	2,850	700	
- Rohtas Industries	4,500	4,050	3,700	3,700	900	
DIAPHRAGM PROCESS						
- Alkali & Chem. Corporation	8,800	5,850	4,400	4,900	1,000	
- Ballarpur India Ballarshah	6,600	2,200	4,000	2,650	1,250	
- Calico, Ahmedabad	2,900	2,650	2,300	1,850	500	
- D.C.M. Chemi Works	29,700	18,000	20,000	22,700	6,900	
- Mettur Chemicals	19,800	16,600	15,300	18,500	4,400	
- Mysore Paper	600	-	-	-	-	
- Rohtas Industries	1,600	-	-	-	-	
- Shree Gopal Paper	6,600	6,650	6,750	8,300	2,450	
- Sirpur Paper	7,200	5,800	5,100	5,150	1,300	
- Tata Chemicals	11,400	5,900	5,950	5,700	1,400	
- Titaghur Paper	7,500	4,800	4,600	4,850	1,050	
CHEMICAL PROCESS						
- Saurashtra Chemicals	23,300	24,950	23,900	22,600	5,650	
- Grand Total	7,82,350	4,97,150	5,13,150	5,49,950	1,51,250	

- Total Mercury Process	6,56,350	4,03,750	4,20,850	4,52,750	1,25,350	
- Total Diaphragm Process	1,02,700	68,450	68,400	74,600	20,250	
- Total Chemical Process	23,300	24,950	23,900	22,600	5,650	

Capacity utilisation, which had registered a fall from 76% in 1976 to 72% in 1977, registered a recovery to 76% in 1978. This welcome trend was maintained during the first 3 months of 1979 also. The following table gives a comparative statement of monthwise capacity utilisation during the last 4 years for member units of the Alkali Manufacturers' Association of India, covering 95% of the total installed capacity of the industry.

4. Demand and Availability

During the past few years, the rate of growth in demand for caustic soda has been of the order of 20,000 to 25,000 tonnes per annum as indicated in the following table.

Year	Production (MT)	Demand (MT)	Surplus(+)/Deficit (-)MT
1969	344,000	350,000	- 6,000
1970	362,000	370,000	- 8,000
1971	377,000	395,000	-18,000
1972	394,000	420,000	-26,000
1973	411,000	440,000	-29,000
1974	428,000	460,000	-32,000
1975	440,000	440,000	-
1976	497,000	493,000	+ 4,000
1977	513,000	510,000	+ 3,000

As would be noticed from the above, there was a fall in demand in 1975, due to the general recessionary conditions then prevailing in the country. A recovery was made in 1976. The extent of increase in demand in 1977 was only moderate at around 17,000 tonnes

The year 1978 saw an unforeseen and unprecedented growth in demand for caustic soda to the extent of around 65,000 tonnes. This was due to sudden spurt in general industrial activity, particularly in consuming sectors such as paper, textiles, soaps, rayon etc. Though capacity-wise the industry should have been in a position to meet the situation adequately, constraints on capacity utilization, primarily due to inadequate availability of the main raw materials like power and salt restricted the increase in production levels to 37,000 tonnes only. Even after drawing over 10,000 tonnes from old stocks, it was not possible to meet the increase in demand for the chemical. The extent of unsatisfied demand during 1978 is estimated at around 18,000 tonnes.

5. Future Trends

Apart from the existing total capacity of 7.82 lakh tonnes, 20 industrial licenses/letters of intent are in force for setting up additional capacity, to the tune of a further 4.72 lakh tonnes. Eleven of these schemes relate to expansion of existing units (2.27 lakh tonnes) and nine to the installation of new units (2.45 lakh tonnes). Of this, around 35,000 tonnes of capacity is presently under last stages of implementation, and is expected to fructify during the latter half of 1979. The schemes related to the expansion programmes of Andhra Sugars, Ballarpur Industries (Karwan), and Nepa Mills. The total installed capacity for caustic soda production by end of 1979 is thus expected to be around 8.2 lakh tonnes.

Production during the first 3 months of 1979 has been around 1.5 lakh tonnes. Though there has been a slight reversal in production trends during the second quarter, this is expected to be more than offset during the latter half of the year, when

capacity utilisation, it is hoped, would be better due to increased availability of power during the post-monsoon period, and stabilisation of operation in newly commissioned plants. Taking an overall view, production of caustic soda in 1979, barring any unforeseen circumstances, may be expected to be of the order of 6.1 to 6.2 lakh tonnes.

Though the spurt in demand in 1978 had been of the order of 65,000 tonnes, the same extent of demand growth cannot be visualised in 1979. It is expected to be only around 40,000 to 50,000 tonnes at the most, as the sudden upsurge in some of the main consuming sectors such as paper, textiles, soaps etc. has somewhat stabilised. Thus demand for caustic soda in 1979 is estimated to be around 6.2 lakh tonnes, more or less of the same extent as production. In other words, the gap between demand and supply presently being felt, may be expected to be reduced progressively during the 3rd and 4th quarters of the year.

and 4th quarters of the year.

6. Raw Material Scene

a) Power

While in most of the other industries electricity is used as motive power, in the case of caustic soda, it forms the main raw material. During the past five years, there have been widespread restrictions on usage of power imposed in many states, to varying degrees, and this has been largely responsible for under utilisation of capacities in the affected units. While it is understandable that in a situation of inadequate power availability, some restrictions have to be imposed on its regular consumption, it is unfortunate that in most of the states where power cuts are imposed, the caustic soda industry is specifically discriminated against. Apart from the various notified power cuts, the caustic

soda units are often subjected to un-scheduled additional restrictions. Very often, the electricity authorities resort to power sheddings without notice. Such trippings without prior information resorted to very many times per day, completely disrupt operations in the continuous process of production and also detrimentally affect the life of the plants and equipments. Because of this practice adopted by the power supplying agencies, the fall in production in the consuming units is much more than warranted by the notified cut.

As the short fall in the availability of caustic soda has been occasioned not because of insufficient production capacity, but its low level of utilisation, primarily due to inadequate availability of power, the industry approach the Central Government to intercede with the state authorities for making more power available to the affected units, at least for a temporary period of 4 to 6 months in order to tide over the period of shortages. Though the Ministry of Chemicals & Fertilisers were good enough to take up the matter with the state governments where power cuts were in force, no tangible results could be obtained.

Apart from the problems faced on account of inadequate availability of power, the phenomenal increases in costs on various counts have been a major cause for worry. Though the honourable Finance Minister had stated in Parliament at the time of passing the Finance Act in 1978, that the issue of granting relief to power intensive industries, in the matter of excise duty of power would be considered in consultation with the Ministries concerned, no relief has actually been forthcoming. On the other hand, various electricity boards effected increases in power tariffs to extent much more than that warranted by the imposition of excise levy. Later on, during 1978, and early 1979 many of the State Governments,

Municipal Corporations, etc. have on their part effected unprecedented increases in electricity duties over and above the excise levy imposed under the Central Budget. Various State Governments have also hiked up the electricity tariffs to unprecedented levels - example: The tariff rate in Tamil Nadu has been recently increased by about 12 paise per KWh. These unilateral and indiscriminate increase in the cost of electricity, which forms the main raw material for the caustic soda industry, has completely vitiated the economics of operation in most of the units. This uncertainty regarding availability, and the frequent, substantial and unilateral increases in costs of power, have been the major contributing factors in entrepreneurs' reluctance in entering the field of caustic soda production. It is understood that no application for setting up additional capacities in this industry has been received by government during the past 15 months.

In the context of the inadequate availability position of power in India, which may continue for some more years to come, the industry has strongly advocated the need for introduction of the metal anode technology, which would result in substantial saving in power or alternatively increase in caustic soda production using the same extent of electricity. Though facility exists within the country with a single manufacturer for fabrication and coating of the anodes, it may be necessary to establish further indigenous capacity in this field for speedy implementation of projects. The technique for coating of the anode has been perfected in India. While designing and fabrication of anodes for diaphragm cells should not pose problems, the same is not the case with process cells, because of the wide variety of non-standard sizes in existence.

b) Salt

Though availability position of salt, which was rather acute towards end of 1977 and early 1978, somewhat eased, as the year progressed, procurement of the commodity of suitable quality continued to pose problems to most of the units. Further there has been no let up in the high price levels, which had mounted to over 3 times of what they used to be 2 years ago.

Steadily mounting transport costs is another problem the industry has to face. While the imposition of surcharge on railway freight has further pushed up the cost of transport over the rail, cost of road transport has also become prohibitive consequent on the increase in prices of petroleum products. Availability of ships for coastal movement of the material has also dwindled. All these factors have contributed towards un-precedented increases in the delivered cost of salt to practically all the units.

Apart from the problem of costs, inadequate availability of rail wagons for transport of the material to the factories continues to constitute a major hurdle.

c) Graphite Anodes

Indigenous availability of graphite anodes continued to remain minimal on account of various problems faced by the only local producer. Though direct imports under automatic and supplementary licencing schemes have been permitted, these have not materially mitigated the difficulties of the industry, in view of the restricted availability abroad and the long delivery schedules stipulated by the foreign suppliers. Congestion in major Indian ports also contributed towards worsening of the situation.

Prices of anodes have been increased by 30 to 40 per cent by the indigenous supplier and the foreign suppliers are also not lagging behind in effecting price increases. Heavy import duty has pushed up the delivered cost of this essential raw material. Withdrawal of the exemption from payment of countervailing duty, earlier granted, has resulted in the imported supplies becoming further costlier. Representations to Government in this connection have still not with any positive results.

d) Mercury

This has been the only item, the cost of which had fallen considerably during the past years, though the impact thereof on cost of production is negligible because of the very small quantities consumed. Unfortunately, in the case of this item also, prices have been nearly doubled recently by the canalising agency, probably due to increase in the international prices. Releases by the MMTC are also reported to have been reduced during the past few months due to inadequate availability of the material.

Pressure on other manufacturing expenses such as cost of auxiliary chemicals, wages, stores and spares, maintenance, overheads etc., continue to spiral upwards. The following table indicates the progressive rise in costs of essential inputs to the industry during the past few years.

TRENDS IN COST OF MAIN RAW MATERIALS

Item	Unit	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
											April June Estimated
Salt	Rs/ tonne	82	86	90	96	110	120	127	138	171	191
Power	Paise/ KWh	6.9	7.0	8.1	9.0	11.4	14.0	15.0	15.7	19.2	23.6
Graphite	Rs/kg.	14	15	16	17	21	28	32	30	33	41
Mercury	Rs/kg.	148	136	108	107	107	96	69	61	62	72
Fuel	Rs/ tonne	223	268	295	323	336	774	983	1043	1089	1125

e) Chlorine Utilisation (By-product)

One heartening feature during the year has been the increase in the gainful utilisation of chlorine, which attained an average figure of 90%. The following table illustrates the progress in chlorine utilisation during the current decade.

Year	Chlorine produced	Chlorine gainfully utilised	% of utili- sation	Increase in quantity utilised over previous year (%)
1970	311	245	79	
1971	322	270	84	10.2
1972	337	284	84	5.2
1973	354	287	81	1.1
1974	361	305	85	6.3
1975	369	316	86	3.6
1976	416	344	83	8.9
1977	434	382	88	11.0
1978	470	423	90	10.7

(BS)

CURRENT TECHNICAL LITERATURE

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SCIENCE AND TECHNOLOGY

Rural Development

- 106 SUKH DEV: Rural development - outline of an approach. Journal of Scientific & Industrial Research, 1978, 37(8), 389-392.

A plausible approach to tackle the problem of rural development is outlined. Industries/items suitable for the rural sector such as agriculture-based, forest-based, mineral/clay-based and traditional handicrafts are identified and formation of cooperatives with little participation from 'outsiders' is suggested.

- 107 TILAK B D: Rural development through science and technology. Chemical Industry News, 1979, 24(7), 440-448.

Enumerates some initiatives regarding rural development through science and technology and major activity of the NCL Rural Development Centre and suggests some projects in each area where science and technology, engineering and scientific management will play an important and innovative role. (BS)

Small Industry

- 108 SHARMA M K: New small scale units - causes of incipient sickness. Indian Bicycle Ambassador, 1979. 22(6), 27-29.

Gives the background of the entrepreneurs who start the new units and their state of ignorance on functions of other governmental agencies. Presents the general factors that cause sickness in small scale units. (SS)

- 109 SUNDARAM S: Sickness in small units, - causes and cures. Chemical Weekly, 1979, 24(15), 86-88.

Analyses the reasons for sickness in industries and suggests some solutions to prevent sickness. (MSR)

- 110 THOMAS T: The relationship between small scale and large scale industry. Indian Chemical Engineer, 1979, 21(1), 14-21.

The emotional and rational factors underlying the policy of promoting the small scale sector have been analysed. Some of the major limitations of the present policy, which states that whatever can be produced in the small scale sector must be produced by that sector alone, have been exposed. It has been shown that indiscriminate promotion of small scale industry, defined merely in terms of size of capital, need not result in increased employment or the most efficient use of scarce resources like capital and land. Very important factors like consumer interest, market linkage, the efficient use of resources, need for innovation necessitate the continued growth of large scale industry. Therefore, the role of the small scale sector has to be seen as complementary to that of the large scale sector and not one of exclusive dominance in a widening range of activities.

OILS AND FATS

- 111 MAXWELL R J & SCHWARTZ D P: A rapid, quantitative procedure for measuring the unsaponifiable matter from animal, marine and plant oils. Journal of the American Oil Chemists' Society, 1979, 56(6), 634-636.

A simple, rapid, quantitative procedure for measuring the unsaponifiable matter (USM) in animal, marine and plant oils is described. Saponification is achieved by a short heating period. The resultant soap mixture is then ground together with Celite powder, transferred to a glass column, and the USM is eluted with small amounts of dichloromethane.

- 112 MAZUMDAR U K & SENGUPTA A: Triglyceride composition of chrysalis oil, an insect lipid. Journal of the American Oil Chemists' Society, 1979, 56(6), 620-623.

Chrysalis oil, an insect fat obtained from spent silk worm pupae, *Bombyx mori*, is a by-product of sericultural industry and represents a potential source of 1750 tons of linolenic-rich oil per annum for India. Fatty acid and triglyceride compositions of chrysalis oil have been determined segregation, lipolysis, thin layer and gas liquid chromatography. (AA)

- 113 MOTIUK K: Wool wax alcohols: a review. Journal of the American Oil Chemists' Society, 1979, 56(6), 651-658.

Wool wax alcohols consist of aliphatic monoalcohols and alkane 1,2 diols, cholesterol, triterpene alcohols and small amounts of hydrocarbons and autoxidation products. The monoalcohols and the diols consist of normal, iso and anteiso series. The average composition of the wool wax alcohols is based on data which were published during the past 25 years. (AA)

FOOD AND ALLIED INDUSTRIES

Dairy Products

- 114 ABICHANDANI H & ZAIDI A H: Cryogenic applications in dairy production, processing and transportation. Indian Dairyman, 1979, 31(10), 705-710.

- 115 KILARA ARUN: Use of immobilized enzymes in the food and dairy industry. Indian Dairyman, 1979, 31(10), 703-704.

Highlights the role and commercial utilisation of immobilised enzymes in the food and dairy industry. It also covers parameters affecting immobilization, processes adopted commercially and R & D work. (MKSS)

Poultry Products

- 116 DASARATHA RAO: Rural-based poultry industry India. Poultry Guide, 1979, 16(9), 37-40.
- 117 NAGABHUSHANA RAO B et al: Economics of poultry farming - a case study at Bapatla in Guntur District. (A.P.). Poultry Guide, 1979, 16(9), 43-47.
- 118 PANDA B et al: Processing and preservation of quail products. Poultry Guide, 1979, 16(11), 85-97.
- 119 THIAGARAJAN M: Shelter engineering-choice of roofing material for tropical poultry housing. Poultry Advisor, 1979, 12(11), 29-31.

Comparative merits of different roofing materials are discussed in detail. (MKSS)

TEXTILE & FIBRE INDUSTRIES

- 120 MEHRA R H: Textile auxiliaries - a miscellany. Man-made Textiles in India, 1979, 22(6), 285-303.

A brief history of the use of textile auxiliaries in the process house is given. The various textile auxiliaries available today are then classified according to their ionic character viz: anionic or anion-active cationic or cation-active, non-ionic and ampholytic or amphoteric, and examples cited for each type. This is followed by the classification of auxiliary chemicals according to their use in the process house starting from desizing, bleaching, mercerising, dyeing, printing and finishing. Finally, recent auxiliaries are outlined.

- 121 PARIKH J G: Hosiery in India; problems & prospects. Man-made Textile in India, 1979, 22(11), 587-589.

Discusses the problems involved in technology, machinery, training, raw materials and quality control in hosiery

industry and gives some solutions to the same. (BS)

- 122 PATEL B K: Use of yellow wool in hand-woven carpet industry. Colourage. 1978, 25(16), 53-57.

Reviews upto-date progress in the hand-woven carpet industry with particular reference to yarn quality, carpet design, hand performance in carpets, economics of colouration, pile look, performance of carpet piles and assessment of carpets. (BS)

- 123 PHILIP K V: Indian woollen industry in the world markets-direction and diversity of woollen textiles export-progress and prospects analysed. Wool & Woollens of India, 1979, 15(4), 73-77.

CHEMICAL INDUSTRIES

- 124 ---- : Adsorption refining of mineral lubricating oils using a moving adsorbent. Colour and Chemicals Weekly, 1979, 5(6), 43-44.

The technology is based on the principle of adsorptive fraction of hydrocarbons and provides for the removal of polycyclic aromatic hydrocarbons, resinous compounds and other undesirable impurities from the lubricating oil feedstock. The technical process and advantages are outlined. (MSR)

- 125 CILBOURNE D: Small ethylene plants can still be economical. Chemical Weekly, 1979, 24(15), 78-80, 82-85.

Analyses the factors that can make a small ethylene plant more profitable than a large scale ethylene plant in a developing country. The suggested capacity of the plant is about 70-150000 tons/year. (MSR)

- 126 HAIDEGGER E J & DOOLEY R C: Furfural - some technical and economical aspects of its production. Chemical Age of India, 1978, 29(6), 397-403.

Describes the formation of furfural and the problems which can occur at the various stages of furfural production. (KSDR)

- 127 KHARBANDA O P: Hydrochloric acid. Chemical Weekly, 1979, 24(29), 164-167.

Process flowchart, equations involved and requirement for the manufacture of hydrochloric acid are given. Production, exports and future of Hydrochloric acid are also given. (MSR)

- 128 KHARBANDA O P: Inorganic chemicals in India. Chemical Economy & Engineering Review, 1978, 10(12), 25-32.

The top (volume) 10 inorganic chemicals with their recent production figures for USA and India are listed. Volume of production in few selected countries for the 4 major inorganics are given. The capacity utilisation in recent years for India and USA are also given. (BS)

- 129 KHARBANDA O P: Small is beautiful.. Chemical Economy & Engineering Review, 1979, 11(9), 39-42.

Discusses the aspects of economy of scale, optimum size, production cost vs. capacity and plant utilisation of process plants. (BS)

- 130 PANCHARATNAM S: Process alternatives for sodium sulphate. Chemical Age of India, 1979, 30(4), 327-331.

Lake brines in Rajasthan as well as sea-bitterns from solar salt facilities provide economic means of producing sodium sulphate. Conventional and new process alternative have been analysed in detail to arrive at the best scheme for utilising these resources. (AA)

- 131 REVATI: Rajasthan forges ahead in minerals and chemicals. The Chemical Times, 1980, 7(5), 8.

Reviews certain important projects, mainly in the chemical and allied industries, set up by the Rajasthan State Industrial & Mineral Development Corporation Limited, (RSIMDC) on its own, or promoted by it in the joint sector, or helped to be put up in the private sector. These include units already in production, under implementation and those for which licences/letters of intents have been received. (BS)

Chemical Process Equipment

- 132 ---- : Glass filter as a boom to laboratory and research. Chemical Weekly, 1979, 25(7), 54-56.

Presents the technical details of glass filters. (SSD)

- 133 MAZUMDAR A H: Maintenance management in chemical industries. Part VIII; Maintenance & safety. Chemical Industry News, 1979, 24(8), 531-536.

Discusses how plant maintenance contributes for safe operations and presents the results of the survey conducted for this purpose. (BS)

- 134 PAL S: Electrostatic precipitator: Basic principles and applications in industries. Indian Chemical Manufacturer, 1979, 17(7), 21-30.

Describes the basic theory of electrostatic precipitation (ESP) and various industrial applications of ESP in cleaning exhaust gases. (BS)

SURFACE COATINGS

- 135 ---- : Developments in printing ink production methods. Paint Manufacturer, 1978, 48(8), 17-18.

Describes the paste and liquid inks and their production methods. (KSDR)

136 ---- : Organic pigments. Chemisphere, 1979, 3(45), 24-26.
Preparation and application of anthraquinone group of
vat pigments are outlined. (MSR)

137 ---- : Titanium dioxide: Product profile. The Chemical Times, 1979, 6(39), 3, 10.

Gives details on the qualitative and quantitative analysis
of TiO_2 pigments, requirements for composition of extended
 TiO_2 pigment and use pattern of TiO_2 . (JBS)

138 ---- : Titanium dioxide. The Chemical Times, 1980, 7(3),
3 & 16.

Gives the chemistry and technical data, raw materials
required, manufacturing process, production and growth
in demand in India, applications and end uses and finally
price and availability trends in past five years for
titanium dioxide. (BS)

139 BOXALL J: A history of paint technology Part Four. The 20th
century. Paint Manufacturer, 1978, 48(7), 18, 21, 23.

PLASTICS

140 ---- : Welding assembly and bonding: techniques and applica-
tions for joining plastics. European Plastics News, 1979,
6(3), 11-14, 17, 19-20, 22-23, 26-28.

Gives the state-of-the-art for the five welding methods,
viz. hot gas, high frequency, hot plate and ultrasonic.
Discusses also the role of adhesives. (KSDR)

141 CARMEN A J: A total system concept for injection moulding FRP.
Plastics Design & Processing, 1978, 18(8), 25-30.

Briefly describes the total system equipment, materials,
moulding trials and comparative testing, and the system
evaluation. (KSDR)

- 142 CHACO N C: Let us make more use of FRP. Colour & Chemicals Weekly, 1979, 4(48), 47-48.

Advantages and applications of fibreglass reinforced plastics (FRP) are described. There are about 600 processing units, a majority of which belong to the small sector. (MSR)

- 143 GULATI N K : Glass reinforced plastics - common problems & remedies. Chemical Engineering World, 1979, 14(8), 61-67.

Gives the limitations and properties of the resins when reinforced with glass fibre and also the properties of glass filaments. Indicates various moulding problems and their remedies. (KSDR)

- 144 SRINIVASAN S R: Growth prospects of polymer industry in India. Colour & Chemicals Weekly, 1979, 4(48), 30, 31, 33, 35.

A list of thermoplastic raw materials manufacturers with their products, licensed capacity, raw materials and year of establishment are given. Naphtha cracker facilities in India are tabulated with capacities. Projected demand of plastics for the years 1982-84 and 1987-88 is presented. Raw materials required for manmade fibres and progress of this industry during the period 1970-74 are also given. (MSR)

- 145 TUNBRIDGE T: More sophisticated machinery for the polymer industry. Chemical Weekly, 1979, 24(15), 50, 52, 54.

LEATHER INDUSTRY

- 146 BLEY W J: Problems in the finished leather production. Leather Markets, 1979, 9(2), 21-28.

Highlights the problems involved in the manufacture and processing of wet blues, crust leather and reviews the

prospects for future developments. (BS)

- 147 DUTTA S S: Zirconium tannage. Journal of the Indian Leather Technologists' Association, 1979, 27(3), 8-13.

Highlights the history of tanning industry and chemistry of zirconium sulphate. Describes the process of zirconium tanning together with a process for cheaper zirconium tannage. (BS)

- 148 KAMAT D H et al: Economic evaluation of imported hides. Leather Processing, 1979, 2(10), 16-17.

The relative economics of the manufacture of different types of leathers that could be produced from indigenous hides have been examined and reported.

- 149 PARTHASARATHY K & OLIVANNAN M S: Manufacture of chrome retan upper leathers. Leather Markets, 1979, 9(2), 8-10.

Gives the day-by-day sequence of operations involved in the manufacture of chrome retan upper leathers. (BS)

- 150 PRASAD L M & KHANNA J K: Economics of bag tanned leathers. Leather processing, 1979, 3(2), 15-17.

Gives the process for manufacturing bag tanned leather and pit tanned leather and brings out economic comparison of both the processes. (BS)

ELECTRICAL INDUSTRIES

- 151 ---- : Micromotors make sophisticated products possible. Journal of Electronic Engineering, 1979, 16(151), 36-37.

Briefly explains AC motors, DC motors, stepping motors, DC micromotors, Fan-motors and motors for VTRs. (VVR)

- 152 ABE K: Synchro motors achieve improvements to meet stringent requirements. Journal of Electronic Engineering, 1979, 16(151), 45-47.

- Discusses recent trends in microsychromotors, brushless synchomotors and pencake synchomotors, etc. along with recent applications. (VVR)
- 153 GHOSH S N: Failure of induction motors. Electrical India, 1979, 19(16), 15-16C.
Common faults such as S.C. Fault, OC Fault, ground fault, bearing fault etc which normally occur in induction motors are enumerated. (LKPC)
- 154 JANARDHAN RAO N A & MANJUNATH K V: Development of brushless generators in India. Electrical India, 1979, 19(16), 16E-16G.
Discusses the design of brushless generator with rating smaller than 2MVA. (LKPC)
- 155 MAJUMDAR SUBIR: Basic types of FHP motor. Electrical India, 1979, 19(16), 29-32, 33-38.
Different types of fractional and subfractional horse power motors are discussed with diagrams and characteristic graphs. (LKPC)
- 156 MEHTA P P: Problems of small scale electric motor manufacturer. Electrical India, 1979, 19(16), 55-56.
Enumerates some problems faced by small scale electric motor manufacturers with regard to bank loans, excise duty, tariff and sales tax. (LKPC)

ELECTRONICS INDUSTRIES

- 157 JAIN A K: Solder alloys in electronics industry. Electronics Information and Planning, 1979, 6(10), 836-840.
A variety of alloys are used as solders in the electronics industry. A demand estimate of solders for the industry has been made for the year 1983-84. (MVS)
- 158 NAG B: Component progress and computer development. Electronics Information and Planning, 1979, 6(10), 827-835.

SENDOC SERVICES

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Note:- DIC - District Industries Centre, Ent. - Entrepreneur,
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 SI - Small Industry.

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Sowing crops directly into unploughed ground, after a single herbicide application, may seem like an easy way to farm if it works. But it is not really such a far-fetched idea. In fact, if conditions are right, it can lead to good crop yields and help preserve topsoil. It also saves the farmer time and, significantly, can cut his fuel bill by about one-third.

When all operating costs - machinery, fuel, seed fertilizer and herbicides - are taken into account, the direct drilling strategy looks as if it will often be a good bet. And the balance between yield and energy input will look more attractive as oil prices rise further.

A new machine, which seeds a crop straight into unploughed ground, is now undergoing field trials by officers of the CSIRO Division of Plant Industry, who started developing it some years ago.

Conventional tillage involves up to eight passes over the paddock to break up the soil, eliminate weeds and produce a satisfactory seed bed. This leaves the ground exposed to wind and water erosion.

It was the potential for conserving the erosion-prone soils of the slopes and tablelands of New South Wales that led some 12 years ago to a study of reduced tillage at the Division's

Ginninderra Experimental Station near Canberra. The researchers ran into a problem; there was no satisfactory implement for direct seeding on the market at the time. So the Division had to develop its own machine, now called Siroseeder.

This work gave rise to the construction of a number of prototypes culminating in the manufacture at the Division of a full-sized, 3 tonne machine made from off-the-shelf parts obtained from Australian engineering firms and equipment manufacturers.

It consists of 12 tyne-mouldboard units, 25 cm apart, and staggered to assist the flow of surface plant residue through the machine. The tyne, a blade with an applicator that drops seed and fertilizer into the soil, opens up the furrow formed by the coulter wheel. The mould-boards push surface material aside, but are shaped to allow top-soil to fall through and cover seed in the furrow.

Provision of independent depth control for each tyne assembly is a feature of the machine, ensuring an even sowing depth on irregular ground. A press wheel located behind each tyne compacts soil over the seed and helps keep sods away from the row.

The machine is capable of drilling under hard soil conditions, often found in pasture paddocks.

A CSIRO team is currently conducting trials - some in cooperation with the New South Wales Department of Agriculture - at a number of locations in the State. The scientists are comparing yields obtained by conventional tillage and the direct-drilling strategy. They are also investigating the factors that affect yields in order to find the optimum operating conditions for Siroseeder.

Should it live up to its early promise, the Division will seek a company to collaborate in further improving Siroseeder. In the meantime, any comments or suggestions from interested groups and individuals are welcome. One possibility would be to produce tyne assemblies that could be fitted to any suitable frame.

For more information: CSIRO Division of Plant Industry,
P.O.Box 1600, Canberra City, A.C.T. 2601, Australia.

Spreader for Granular Nematicides

A new system of applying granular nematicides to the top-soil to control the nematodes that attack potatoes and other crops has been devised by Dr.A.G. Whitehead and Mr.D.J.Tite of Rothamsted Experimental Station.

Most field crops are liable to attack by tiny, translucent worms called nematodes ('eelworms'), which can occur in enormous numbers in the soil. Cystnematodes can cause severe yield losses in several crops, especially potatoes. Damage to potatoes and other crops can now be prevented by treating infested soil with an effective granular nematicide, such as oxamyl ('Vydate') or aldicarb ('Temik'). To minimise nematode increase, and so avoid the need for long rotations, the granules must be mixed thoroughly with the top 12.15 cm of the soil just before planting in the spring.

Broadcasting the granules on the soil surface and harrowing them in is usually unsatisfactory, because three-quarters of the granules remain in the top 5 cm of the soil. Rotavating the granules ensures adequate incorporation but is slow and may harm soil structure.

In the new system, granules are blown into vertical bands 25 cm. apart in the top 12-15 cm of the soil, through protected spreading nozzles mounted behind spring or rigid tines on a cultivator tool bar. The granules are then mixed with the soil by a rotary harrow. The nematode control achieved is as good as that obtained by rotavating the granules into the topsoil. Incorporation of granules is faster, weathered and unweathered soil are not mixed as they are by rotavation, and soil structure is unharmed.

The distribution nozzles can be manufactured easily from simply machined components in familiar materials. The granules are metered by land-wheel drive from a hopper into pneumatic tubing through which they are blown by an air blower to the distribution nozzles on the tines and so out into the soil in vertical bands. A prototype has been used successfully in field trials by Rothamsted. Other pesticides or even fertilisers could be spread in the same way by similar machines.

It is expected that this spreader will be most useful to potato growers, of whom there are 35,000 registered in the UK, each with over one acre (average 15 acres). Most European countries are self-sufficient in potatoes, with consumption per head little less than the UK, so there could be substantial export markets for the machine. Patent protection has also been sought in France, West Germany, the Netherlands and the USA.

Companies interested in manufacturing and marketing spreaders of this type under NRDC licence are invited to contact Lewis Wilson, Mechanical and Civil Engineering Group, NRDC, Kings-Gate House, 66-74, Victoria St., London, England.

ELECTRONICS AND ELECTRICAL INDUSTRIES

A Fast-Response Temperature Sensor

Research at the CSIRO Division of Chemical Physics on the bonding of ceramics to metal has led to the development of an improved industrial temperature sensor. It gives faster and more accurate temperature measurement than conventional equipment and is ideally suited for use in process, such as fibre-glass fabrication, where rapid response by temperature controllers to change in temperature is critical. Novatech Australia is now manufacturing the device under licence to CSIRO and Flinders University, S.A.

conventional units usually consist of a thermocouple, the temperature-sensitive element mounted in a ceramic sheath. This sheath protects it from mechanical damage and from chemical attack by the hot environment in, for example, a kiln or furnace. What is new is the 'thermal window' made of platinum (0.25 mm thick) bonded by the Division's reaction bonding process to the base of the sheath.

As the conductivity of the window is much greater than that of the ceramic tube, the thermocouple inside responds more rapidly than it would in a conventional sheath. In fact, the new unit's response in air at 1000°C is five times faster than that of a closed-end ceramic sheath having a wall thickness of about 2 mm.

In many applications, claims the manufacturer, the sensor gives a performance similar to an optical pyrometer - an instrument that measures temperature as a function of light emitted from the hot material - and at a fraction of the cost.

Development of the reaction bonding of metals to ceramics came about as a result of unexpected observations. In 1970 the Division's electron diffraction team was investigating what happens to tiny crystals of magnesium oxide (0.01 mm in size) when heated to 1100°C on a palladium grid in an electron microscope.

What the researchers saw they found at first quite hard to believe. Tentacles seemed to be growing out of the palladium towards the magnesium oxide crystal. Since both the palladium and magnesium oxide were well below their melting points, this was clearly a new kind of reaction that took place prior to melting.

This reaction was filmed and shown at a scientific meeting at which Associate Professor Henk de Bruin of Flinders University, South Australia, was present. He pointed out that the reaction could have the effect, on a large scale, of bonding the metal to the ceramic.

Subsequently, CSIRO and Flinders University filed joint patents on this process, which they named reaction bonding. These patents embrace numerous combinations of ceramics and metals. For example, gold can be bonded to house-brick, ruby or sapphire, copper can be bonded to most refractories and platinum can be joined to sapphire.

One such application of the process is in the manufacture of the fast-response thermocouple sheath. This device resulted from an inquiry from Mr. Arthur Gould, Managing Director of Novatech Australia. His firm wanted to make an improved thermocouple sheath for use in molten glass. Without the protective sheath, the thermocouple would deteriorate rapidly in such an environment.

The CSIRO team thought that this problem could be solved by using reaction bonding to seal a thin disc of platinum metal over the mouth of an open ceramic tube. Experimental work in the Division showed that this was so.

Platinum and alumina are a good combination because they bond very well and platinum is generally inert up to very high temperatures. But the tube could also be made of mullite, zirconia or any of a number of other ceramic materials, and the metal foil could be any other suitable resistant metal.

The sheath can be modified for specialized applications. For example, gold foil may be substituted for platinum when temperature sensing is carried out in a sulphurous atmosphere, as platinum is susceptible to attack by sulphur.

In case where a faster response is required, a larger window can be used. For even faster response, in situations where heat is mainly transferred by radiation, platinum foil may be blackened electrolytically by forming platinum black - a better absorber of heat than untreated platinum - on the face of the metal.

Tests have also been made on a ceramic tube with a domed metal 'tin-hat' protruding from its end. This arrangement has proved useful in situations where gas temperatures are to be measured.

Novatech offers all these options in their commercial units which range in price from about \$60 for the new sheath to about \$100 for the sheath and thermocouple complete. The firm is now launching the product on a number of world markets including America, Japan and Europe.

The sheath represents just one successful application of reaction bonding. The Division would welcome any inquiries regarding the use of the reaction bonding of metals to ceramics in other fields.

For more information: CSIRO Division of Chemical Physics, P.O.Box 160, Clayton, Vic. 3168., Novatech Australia, P.O.Box 145, Albert Park, Vic. 3206., Australia.

Load Cells

The load cell is a basic sensor in an electronic weighing system. The load cell is a transducer which converts the strain on it, due to a weight placed over it, into an electrical signal. Usually the electrical output is low in magnitude and hence requires further electronic circuits for amplification. This magnified output can then be given to devices like printer, recorder etc. to have the value of the weight marked on paper. The load cell, consequently, becomes an important aspect of electronic weighing system for its accuracy, repeatability and reliability, specially in cases where heavy loads such as lorries, huge container, railway wagons, tippers etc. are to be weighed.

At present the load cells are mostly imported though a few parties are also making them indigenously. The load cell developed at National Aeronautical Laboratory, Bangalore is better in accuracy ($\pm 0.1\%$) than what is being indigenously produced ($\pm 0.5\%$) and compares favourably with imported ones. Pricewise, it is cheaper than imported and indigenous load cells.

NAL, Bangalore has developed the design for a bonded wire strain gauge column type load cell for 10 tonnes compression loads. This cell consists of a solid cylindrical steel billet

as the load sensing element. The cross-section of the billet is 20 cm square on which 4 bakelitisised wire strain gauges are bonded at its mid portion. Two of the gauges respond to the longitudinal strain while the remaining two are meant for poisson ratio measurement. The assembled gauges are connected to form a wheatstone bridge. It is enclosed in a rugged mild steel jacket and is sealed for protection against atmospheric contaminations. Connections to and from the gauges are provided through a 5 pin hermetic circular connector. The load cell has a sensitivity of 0.5 mV/V, which can be amplified by an external amplifier.

Specifications

Load cell full range output	0.5 mV/V input (nominal)
Input & Output resistance	600 Ohms. (nominal)
Operating temperature range	0°C - 40°C
Linearity & Hysteresis	± 0.1% R.O.
Overload capacity	100% of the rated load

The laboratory has fabricated 6 nos. of load cells and these have been incorporated in the electronic weigh bridge system developed and supplied to a firm in Hyderabad. The system is functioning well.

NAL, Bangalore has estimated the annual consumption of load cells to be about 500 pieces. However, the gap in demand will have to be ascertained by the interested entrepreneur before going into regular production.

The main equipments needed for the production of load cells are: milling machine, grinding facilities, furnace, oven, gauge bonding and testing arrangements, tools for soldering and for mechanical fabrication, digital multimeter, power supplies etc. All are available indigenously.

The main raw materials needed are EN 24 steel, stainless, mild steel, aluminium rods and sheets, wire and foil strain - gauges, electrical connector and hardware materials. All are available indigenously.

Total fixed capital excluding land and building has been estimated at Rs.1.6 lakhs and the cost of production will be about Rs.2,300 per load cell (1979).

Terms of know how transfer: Lump sum Premium: Rs.7,000;
Recurring Royalty: 3%; Period of licence: 7 years; Nature of licence: Nonexclusive.

ENGINEERING INDUSTRIES

Co-ordinate Measuring Machine

The co-ordinate measuring machine is a new approach to an old problem of complexity involved in the inspection of engineering components. Inspection of components calls for a reference plane and a variety of inspection equipment, and depends to a significant extent on the skill of the inspection personnel. The co-ordinate measuring machine virtually eliminates the need for highly skilled inspectors, while increasing the accuracy and repeatability of measurements. It reduces set-up times and errors, thereby resulting in considerable time savings accompanied by consistency of results and less operator fatigue. Since the inspection procedure does not involve rotation of components, related loss of original reference points is eliminated.

Considering the importance of inspection of components in our day-to-day R & D work, the Engineering Services Division of the National Aeronautical Laboratory (NAL), Bangalore has designed.

developed and fabricated a 2-dimensional optical Co-ordinate measuring machine. The machine operates by the movement of a measuring probe to scan any point within its working volume and is capable of adopting both cartesian and polar measuring methods.

The machine basically comprises conventional roller bearings having high rigidity although they tend to give higher frictional drag than air bearings. The roller bearings have an additional advantage over the air bearings in that they have high dynamic stiffness and take less setting times.

The measuring elements of the system consists of accurately etched and polished scales and optical readout systems. With the use of accessories like centrescope, tapered probes, centre punch and edge finders, both contacting and non-contacting measuring techniques can be adopted.

A close grained cast iron surface plate of grade 'AA' forms the reference plane over which components are placed for inspection. The bridge structure of the carriage permits omnidirectional loading and allows staging of considerably long-components to facilitate inspection. The high rigidity of the bridge structure allows the machine for accurate layout and precision measurements. This enables the inspection of components through numeric data marked out in a manner familiar to the shop personnel.

The machine has been tested to evaluate accuracy using auto-collimator and laser interferometer. The experimental results obtained hitherto after repeated measurements have indicated its satisfactory functioning. Presently, some modifications are being incorporated in the machine to make it adaptable for 3 dimensional co-ordinate measurements.

Specifications:

X - axis	:	24"
Y - axis	:	12"
Resolution	:	$\pm 0.0004''$ and 20 seconds of arc.

Salient Features:

1. High accuracy as a result of rigidity of the base, bridge structure of the carriage, linearity of the optical scales.
2. Maximum accessibility to all sides of the components to be inspected.
3. Single set-up for complete inspection of five sides of the components.
4. Collect type head for quick tool change.
5. Rapid movement, clamping and fine adjustment after clamping, for accurate positioning provided for each axis.

Pedal Pump

A new manually operated pedal pump suitable for rural applications for lifting water from irrigation streams, ponds, open channels and shallow wells etc. has recently been developed by the Central Mechanical Engineering Research Institute, (CMERI), Durgapur. The pump can handle water with mud and other impurities

The pedal pump designed and developed at CMERI can be operated by a person standing on the foot pedal. As the person standing on foot pedal changes his body posture, his body weight is

transferred causing movement of diaphragm whereby a suction is created in one chamber for lifting the water and at the same time, the discharge of water from the other chamber takes place. The discharge takes place twice in each cycle causing continuous flow of water.

An average discharge of 6000 litres/hr. at a head of 2 metres (6 ft.) is obtained. The discharge will depend on the body weight and effort exerted by the operator. The pump can be used upto 3 metres head depending upon the operator's capacity. A farm about half an acre in area can be irrigated in about 8 hr.

Comparative performance of manually operated devices

Name of the Device	Head	Discharge litres/hr.	No. of persons required for operation
Swing basket	0.9 - 1.2 m (3-4 ft.)	3600-5000	2
Counterpoise lift	2 - 3 m (4-10 ft.)	2000-2300	1
Don	0.9 m (3 ft.)	2000	1
Paddle Wheel	0.3 - 0.6 m (1-2 ft.)	18000	1
Archimedean Screw	0.6 - 0.9 m (2-3 ft.)	16000	1
Pedal pump	0.6 - 2.0 m (2-6 ft.)	5000-7000	1

Based on CMERI design a few prototypes have been fabricated. The prototypes were tested extensively.

Since this is a new development the demand could not be estimated immediately. However, the response of the manufacturers and public seems to be overwhelming.

The raw materials and components are available indigenously. It is simple in operation and needs minimum repair and maintenance. Any farmer would be able to do the repair and maintenance job himself.

Any small scale industry with standard machinery and equipments like a lathe, a drilling machine and welding facilities will be able to manufacture these pumps. The design of the pump is available from CMERI, Durgapur for commercial exploitation. A small industry with a capital investment of Rs.2 lakhs can manufacture 200 units per month. Each unit will cost about Rs.250/-.

FOOD AND ALLIED INDUSTRIES

Liquid Sampler for Food Industry

A simple device designed at the CSIRO Meat Research Laboratory for the sampling of effluent and tallow in abattoirs can be put to work in other sectors of the food industry.

The unit allows samples of liquid to be taken at any set depth in a vat, pond or tank without risk of contamination with materials from other levels. It is robust, has few moving parts, and requires little maintenance.

The collector body is designed to fit a standard screw-top jar. The idea is that the operator simply removes and caps each jar, ready for testing in the lab, without the need for transferring the sampler's contents to another container every time a sample is taken.

To take a sample the operator screws a jar into the collector body, attaches the handle and lowers the sampler into the vat to

the required depth. He then pulls the drawcord upward. Liquid enters the jar when the plate that seals its mouth by spring tension moves upwards in response to the pull on the cord. When the cord is released, the plate re-seals the jar. The operator withdraws the sampler from the liquid and then unscrews and caps the jar containing the sample.

If a mesh screen is wrapped around the body of the collector, liquids may be sampled in the presence of coarse solids without fouling the lid.

The device is cheap and easily assembled. It can be adapted for sampling extremely hot or cold fluids provided care is exercised in the choice of materials used in fabrication. The Division is willing to provide design plans and specifications of materials for prospective manufacturers.

For more information: CSIRO Division of Food Research, P.O. Box 12, Cannon Hill, Qld 4170, Australia.

Orange Breakfast Cereal

A new product, 'Orange Sunflakes', a cereal containing orange has been launched in Australia by White Wings Ltd., to assess public acceptance.

The company is using a citrus powder process developed several years ago at the CSIRO Division of Food Research. It blends the powder with whole wheat and corn and adds six essential vitamins and iron. What tumbles into the boxes at the end of the production line are crispy orange 'sunflakes'

The researchers had originally intended to see the powder marketed as the base for an instant citrus drink. They had

looked for a way of utilizing peel left over from making fruit juices. Although small quantities are used in making glazed peel and some is fed to stock or used as compost, most is dumped.

Yet three-quarters of the total vitamin C content of the fruit is located in the peel, as are most of the essential flavouring oils and colouring pigments.

In the CSIRO process, pith, which is responsible for causing bitterness, is shaved from peel left over from juicing machines. The peels are then steam heated and milled to provide a smooth paste that is finally drum dried to produce the powder. Addition of sugar and juice concentrate improves the flavour.

Soy Milk - A Tasty Source of Protein

Soybean 'milk' has a 2000 year old history as an oriental beverage. Today it is as much a part of everyday life to the school-children of South-east Asia as dairy milk is to Western children. They can buy the beany beverage at roadside stalls and at school. For them it is a flavoursome, sweet drink.

Currently, sweet-tasting soy milk drinks, from such places as Hong Kong and Fiji, can be found only in shops specializing in Asian foods. But a new soybean milk developed at the CSIRO Division of Food Research in Sydney could open up an outlet in the popular drink market. Smooth in texture, light in colour and without a strong beany flavour, the new product has drawn favourable comments from visitors to the Divisions.

The soybean is comparatively new to Australia and is receiving a lot of attention from farmers and researchers. It contains about 20% protein and is also valuable in crop rotation because

it improves soil fertility by taking nitrogen from the air and 'fixing' it in the soil.

It was an industry inquiry about soy milk production that prompted CSIRO food researcher Dr. Don Casimir to investigate ways of processing soybeans. Reports in the scientific literature indicated that the beany flavour is enzyme induced - the action of lipoxidase on the soybean fats.

Most attempts to produce a milk with a bland flavour have involved defatted soy flour or isolated soy protein. But Dr. Casimir thought he could get a satisfactory product with less fuss.

In this process, he rotates dry beans and 0.5% anhydrous sodium bicarbonate in a vacuum tumbler at 10 rpm. The next step is to pressure cook the beans for 15 minutes. He then rapidly releases pressure from the vessel so that the pressure inside the beans explodes most of the skins off. The cooked beans are now free of the enzymes that act upon the fats and give rise to the beany and bitter flavours.

A pass of the skinned beans and added water through a hammer and colloid-mill reduces the particle size, leaving a milky suspension. Sweetened with a small amount of sugar and with the pH adjusted to 7.2 the milk is ready for canning.

In the laboratory trials, Dr. Casimir vacuum closed the cans before putting them through the Division's pilot-scale flame sterilizer at the rate of 17 per minute. Flame sterilization, a canning technique advocated by the Division, is gradually finding acceptance by the food industry.

For more information: CSIRO Division of Food Research,
Sydney, Australia.

MINERAL BASED INDUSTRIES

Semi-automatic Carbon Analyser

Semi-automatic carbon analyser apparatus is used for the estimation of carbon in steel, alloy steel, cast iron, pig iron, etc. The apparatus is useful for research, development and analytical laboratories. The present demand is being met through imports as well as through indigenous production. The price is about Rs.2,000 per unit.

The apparatus developed by the National Metallurgical Laboratory, Jamshedpur functions on the same principles as the conventional Strohlein type carbon analyser, but incorporates special design features to reduce operational difficulties. It can be attached to a silicon carbide tubular furnace. It is accurate, sufficiently compact and has the advantage of easy operation. The manual operations are reduced to the minimum, thereby eliminating the chances of human error. Specially designed carbon burettes, alkali absorption vessel etc. ensure efficient working of the apparatus.

Glass tubes of different diameters, mild steel sheets, rubber and bakelite items, oxygen gas and indane gas are the main raw materials all of which are available indigenously. The equipment required are glass blowing and light engineering facilities.

Predesign cost data (basis 100 units/year)

Land and building	Rented
Plant and machinery	Rs.0.20 lakh
Working Capital	Rs.1.00 lakh
Cost of Production	Rs.0.015 lakh/unit

Two prototypes produced on the laboratory scale are in operation, and can be demonstrated to entrepreneurs interested in taking up the design. The apparatus can be easily manufactured by units in the small scale sector possessing glass blowing and light engineering facilities.

Small Glassware Plant

A small-scale glass making-plant capable of producing a wide range of glassware, jars, bottles, ashtrays, etc. has joined the list of small-scale plants developed by Development Techniques Ltd.

Development Techniques is the industrial research and development arm of the Intermediate Technology Development Group, which has already pioneered a small-scale paper pulp packaging plant, eight of which are successfully producing egg trays and other paper pulp products in various countries in Africa.

The new glass plant can be supplied as a package deal, complete with all the necessary equipment for the furnace and annealing ovens, including refractory bricks, thermocouples, burners, semi-automatic moulding and glass pressing machines, weighing equipment, and batch mixer.

Part of the package includes provisions for testing of raw materials from the proposed site and submitting samples made from the material. Other services which can be provided include advice and assistance on the selection of the site and the provision of competent personnel to erect and commission the plant and to train the operators.

This new small-scale plant is extraordinarily flexible in that it is designed to use oil or gas heating; waste heat from the furnace is fed to the annealing ovens to ensure economical use. Also, while the basic unit is designed to produce about two tons of glassware per day, by making additions to the furnace and operating a 24-hour cycle, output can be increased threefold. Basic labour requirements total 11 persons.

This plant fills an intermediate gap in the range of glass manufacturing techniques and enquiries are already being received from interested parties. For further information contact Peter Reid at: Intermediate Technology Development Group (ITDG), Parnell House, 25 Wilton Road, London SW1V 1JS, England.

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New Machinery and Equipment

ENGINEERING EQUIPMENT

"Indamag" Crack Detectors

Industrial Applications have substantially widened their range of electrical portable magnetic crack detectors. The latest range now consists of over 40 different models offering magnetising current capacities from 250 Amps to 3000 Amps output, single or variable AC, half wave DC, full wave DC, AC-HWDC or AC-FWDC combinations with certain added sophistications and convenience of operation. "INDAMAG" Crack Detector is a compact, handy, economical and portable model for detection of hairline, microscopic invisible cracks and flaws in ferromagnetic materials. It is a simplified, nonhazardous and efficient non-destructive testing tool for quality control and inspection. Its function is to provide high amperage, low voltage magnetising current used for developing temporary magnetic field in the object of inspection for detection of invisible, microscopic, surface or near-surface internal fault by application of magnetic particle inspection technique. With this method, the test object is magnetised by longitudinal or circular magnetisation. When the magnetic medium, dry or wet, is applied to a surface containing a crack, the medium moves towards the straying field and deposits on the crack visually indicating the fault in the test piece. The equipment thus locates and identifies cracks right on the object, helps determine the cause of defects and leads to corrective measures. It operates on AC mains and inspects the test

materials very speedily. Because of its simplified operation, even a semiskilled workman can operate it. The selection of model would depend on bulk, shape, dimensions, surface condition, magnetic property and type of test materials.

For further details please contact: Industrial Applications, 119, Sardar Nagar, Chhani Road, Baroda-390 002.

Pneumatic Panel Actuators

A range of interchangeable pneumatic panel actuators, manufactured to international metric panel mounting standards, has been introduced by Kay Pneumatics Ltd. Designated KMA Series, these units incorporate a bayonet plug-in concept that is said to permit full interchangeability from a wide range of actuator types. The entire range employs a standard bayonet socket which can be mounted behind panels up to 7 mm. thick by twin jacking screws. The international standard panel hole diameter of 22.5 mm has been adopted to promote interchangeability between existing electrical panel actuators and these intrinsically safe pneumatic types.

For simple pneumatic control applications, the company's Power Logic 3- or 5-port spool valves may be mounted directly behind the panel; in this instance, the actuator module is an integral part of the valve body. For more complex control circuits, however, a clean and uncluttered panel of high packing density is achieved by grouping the spool valves together, often on a common manifold, and positioning them in a remote, accessible enclosure. In this case, the actuator module alone is mounted behind the panel. A single pipe connects each actuator to its control valve through simple push-in pipe fittings.

The standard actuator is a 25 mm. dia. button, flush mounted inside the bezel. Options include raised, mushroom, key operated, key locked, spring return rotary and two position rotary actuators. The raised or mushroom headed types have the advantage of button colour recognition in profile. Push buttons and mushroom head buttons are moulded in red or green colour options. Quantity orders can be supplied in black, yellow, blue and white, and may be ordered with a variety of ISO standard legends blocked onto their surface. Bezel rings are offered in anodised aluminium alloy, chrome plated or plastic material: they screw on in front of the panel against a nitrile sealing washer to render the panel splash-proof. A flexible sealing diaphragm is offered to prevent ingress of fluids around the push button when used in applications involving slurries.

Inquiries to: Kay Pneumatics Ltd. London Road, Dunstable, Beds. LU6 3DL, England.

Sack Cleaning Plant

SAS sack cleaning plant is a self-contained unit for handling large numbers of sacks or bags. The machine will clean all types of sacks, removing the residue from them and collecting it separately. In many cases the material collected from the sacks fully meets the cost of the plant itself. Any standard size sack can be handled and the sack is turned fully inside out, including the corners, so that there are no pockets from which the dust and dirt are not fully removed. Cleaning action is said to be quite gentle. The cleaning process is simple and foolproof-over 300 sacks can be cleaned and turned per hour. The bag is merely held under the cleaning nozzle and pulled away. This process is repeated and the sack is then completely cleaned of all dry material and dust.

For further information write to: SAS Aerotechnik Engineers Pvt. Ltd., 12/7/4B, Chakraberia Road South, Calcutta-700025.

Self-Contained Air Compressor

Most recent addition to the range of compressed air packages by A.P.E. - Belliss Ltd., is a self-contained unit which is transportable, carries its own fuel supply and requires no electrical or water connections. Known as the Commander, the diesel engine powered unit incorporates compressor, filters, silencers, diesel engine power unit and control panel, all mounted on a heavy skid base which incorporates the integral fuel storage system. The control panel provides full control and fail-safe protection, with visual readout of running hours, tachometer and fuel level.

The compressor is an air cooled, medium-duty unit of reciprocating design, with either two or four V-cylinders to produce outputs of 300 or 600 cu.ft. per min. Features include duplex pistons and matched connecting rods to promote good balance and smooth running characteristics.

A foot or flange mounted diesel engine, driving through a flexible coupling, powers the compressor at 1,500 r.p.m. A number of different engines can be used. Antivibration mountings between compressor, engine and base plate are fitted to enhance smooth running.

Inquiries to: A.P.E. Belliss Ltd., Icknield Square, Birmingham B16 0QL, England.

ELECTRONICS AND ELECTRICAL EQUIPMENT

Electronic Hand Drier

An automatic electronic hand drier, for use in hotels,

airports, executive offices, railway waiting rooms, bus stations and other public areas, (where cleanliness and hygiene is a must) is offered by Bismen, Bombay.

The drier starts and stops automatically. It is hygienic compared to towels and other cleaning aids, and safer than manually operated driers since no button has to be pressed with wet hands to initiate operation. Hot air is supplied by specially designed, heavy thrust tangential air blowers over a pair of heaters. On/off operation is electronically controlled through switching circuits and time delay circuitry. The units are thoroughly tested for endurance, reliability and vibration.

For more information write to: Bismen, G-38 Shalimar Industrial Estate, Matunga, Bombay 400 019.

Low Cost Gear Drive Unit with Maximum Power

Geared micro motor is based on planetary gear system. The unit delivers power of more than 1 to 1000 power ratio. It is rugged and compact, concealed in heavy thick plates. Each gear shaft and output shaft is designed to withstand thrice the maximum load. The unit is totally enclosed in a dust and vermin proof aluminium box which in turn ensures noise-free operation. It incorporates compact design with foot mounting arrangement which imparts greater rigidity to the unit. As such this gear drive unit is 3000 to 1 RPM product, which delivers a minimum torque of 15 kg/cm. The motor is designed specially to suit the torque requirement at the minimum voltage.

The motor terminal leads are covered with Teflon insulation. The design and construction have been subjected to stringent standards, quality control and inspection. The product is wholly

indigenous and at the same time compatibility has been maintained between cost and performance.

Voltage	: 230 V AC
Current	: 50 Ma
Frequency	: 50 Hz
Phase	: Single
Rating	: Continuous
Input	: 6 W
Overall dimension	: 120 x 135 x 107
Insulation	: Heat Class 'B'
Weight	: 1.750 Gm
Output shaft diameter	: 6 mm
Extension	: 25 mm
Output speed	: 1 RPM
Torque	: 15 Kg/Cm
Rotation	: Clockwise

Applications

- Rottessorie gear drive unit for cooking range
- Various process control instruments involving slow motor, high torque application in high temperature condition.
- Turn table & drum rotating devices
- Timer relays
- Laboratory equipments

For further information please contact: Micromotors, Schan Mansion, Mahatma Gandhi Road, Secunderabad-500 003.

Reed Relay

Pioneers in reed relay field, PLA introduces dual-in-line packaged reed relay, an inclusion in the family of reed relays.

PLA DIP reed relay is highly reliable, available in the smallest size possible. It is designed for direct insertion into standard I.C. sockets and ideal for direct PVB mounting. It is provided with magnetic shield.

PLA DIP reed relay is available presently with IN/D contact while 2N/D, IC/D & 2C/D reed relays will be available shortly.

PLA DIP reed relay is IC/TTL compatible. It has contacts suitable for 15 watts with maximum switching voltage 200 VDC/125 VAC (RMS) and maximum current 0.5 AMPS DC/AC (RMS)

For further details please contact: Starch & Allied Industries, Electronic Division, Thakore Estate, Kurla Kiroli Road, Vidyavihar (West), Bombay-400 086.

Surge Comparison Tester

The Electronics Corporations of India (ECIL), has developed India's first high potential surge testing device for non-destructive testing of all types of single phase and three phase electrical windings.

Called the surge comparison tester (Model ST 79), this versatile equipment uses balance and comparison method to make it indispensable for all manufacturing and servicing organisations of generators, motors and transformers.

The tester is a single device for detecting both coil and adjacent armature segment winding defects. It detects and locates the nature of an array of winding faults like winding dissymmetry, short-circuits, improper connections and grounding, phase to phase short circuits, open windings and wrong number of turns on an in-built oscilloscope; the capacity of the device to detect a wide range of faults makes it useful for go-on inspection in production shops.

The equipment operates from two positions. First position checks coil winding faults. High voltage surges are applied alternatively to standard and test coils. If the two windings are identical, both traces will coincide. Deviation in traces indicates faults.

More turns in test coil are indicated by a wave trace which lags behind that of the standard one. If there are fewer number of turns in the test coil, the indication turns otherwise. Unstable wave form indicates shorted turns and straight line on the scope indicates ground faults or disconnections.

In the second position, the equipment tests similar faults in adjacent armature segments. In this case, surge voltage is applied directly across the adjacent armature segments without any intervening impedance.

METALLURGICAL EQUIPMENT

Portable Local Vacuum Electron Beam Welding Machine

A portable local vacuum electron beam welding machine has been developed at the Bhabha Atomic Research Centre. The machine is being used primarily for carrying out circular welds, a type

of welding required in the fabrication of end-shields and calorimeters of PHW reactors, boilers and similar pressure vessels.

The electron beam is a small diameter, high density (over a MW/cm^2) heat source. The electron beam unit has a number of advantages over conventional welding units; it welds dissimilar metals, and metals with high melting points; it produces narrow, deep penetrating welds (without edge preparation) in a single pass; and the welds have depth-to-width ratios of 8 to 10, or even higher. The technique also helps in keeping the inescapable shrinkage and distortion associated with welding to a low degree because the heat affected zone on the job is narrow, the heat input per unit length is low, and the welding speed very high. There is also the incidental advantage of reduced contamination of the weld from the environment (because of vacuum).

The welding operation is carried out inside a vacuum chamber because the electron gun, which generates the electron beam, can function well only at pressures as low as 1×10^{-6} torr (mm of mercury) or better, and also because transport of the beam over long working distances is possible only in a vacuum. The size of the vacuum chamber is thus determined by the size of the component to be welded. This situation is a handicap for heavy industries where the components for welding are often very large, making vacuum chambers prohibitively costly. In view of the heavy cost in recent years, the concept of local vacuum electron beam welding has been investigated. In principle this technique means that instead of enclosing the whole job for welding in a vacuum chamber, a small volume around the weld is locally evacuated by suction cup, sealing the welding machine head onto the component's surface. The welding is carried out by manoeuvring the gun inside the welding head.

The BARC developed machine is designed for welding tubes of diameters in the range of 110 mm to 150 mm to tube sheets, and nozzles of similar diameters on the shells. The machine is rated at 40 KV 12 KW. A maximum weld penetration of 60 mm with depth-to-width ratio of 15, has been obtained in steel with 12 KW power and 12 cms/min.welding speed.

The machine consists of three major systems: (i) Welding head, (ii) Power pack, (iii) Vacuum (pump) pack.

The welding head consists of two small vacuum chambers separated by a rotating plate. The top chamber houses the electron gun, which is mounted on the rotating plate and is evacuated to a pressure of 10^{-4} torr or less by a 500 L/sec diffusion pump. The electron beam enters the bottom chamber through an aperture. In this chamber it is focussed on the piece to be welded by an electromagnetic lens. The bottom chamber houses the electromagnetic lens, a pair of deflection coils, and a centering mandrel to centre the beam with respect to the weld seam. This chamber is fixed directly onto the job through an adapter so that it encloses a small area around the weld. It is evacuated only to a vacuum ranging between 10^{-2} to 10^{-4} torr. This pressure is achieved and maintained, inspite of dynamic leaks, by simple mechanical vacuum pumps, and is sufficient for enabling characteristic narrow EB welds. A pumping speed of 2000 cubic metres per hour is selected so that the desired vacuum of 10^{-2} torr is achieved in about 15 minutes.

The power pack houses the main high voltage power supply rated at 40 KV 12 KW D.C. all auxiliary power, and control panel. All the power supplies and electronic circuits employ solid state components to form a compact system with maximum reliability. The vacuum pumps are housed in the vacuum pack. Both the power pack

are connected to the welding head through flexible connections, an arrangement which allows them to be stationed at a fixed place while the welding head is moved from one weld location to another

The welding sequence is semi-automatic and controlled from a remote panel. All the essential weld parameters are precisely controlled by feedback systems.

This machine has undergone rigorous testing for evaluating its performance and reliability. The welds were examined ultrasonically and radiographically, and then sectioned for metallographic inspection. Test welds were made in S.S. 304, 25 mm thick plate in batches of three, with one cathode to study the reliability value from one test piece to another, and also the effect of replacement of the cathode. The performance evaluation of the machine also included investigation of the effect of cathode replacement on the properties of the welds. The results of the tests revealed that the operation of changing the cathode does not disturb beam spot alignment with the job. All the welds produced with the same parameters were found to have similar geometry and weld penetrations, and free from defects.

Welding Unit

A small portable oxy-acetylene welding and cutting set which carries its own power source and a comprehensive range of equipment has been developed by a British firm.

Mounted on a lightweight trolley, the Portapak offers users a versatile workshop on wheels, enabling them to perform a wide variety of duties which call for comparatively small quantities of gas. With its full range of equipment the trolley weighs only 32 kg (70-5 lb). Its overall measurements are 1 m high x 450 mm

wide x 320 mm deep - small enough to be packed into the boot of a car. It is particularly suitable for work in locations difficult to reach with the much heavier and bulkier gas welding equipment conventionally used. Since the power source travels with the equipment, jobs can be done more conveniently-particularly at height - without the need for long and unsafe trailing hoses between cylinders and equipment.

Applications range from fusion welding of sheet steel upto 8 mm (5/16 in) thick and cutting through steel plate upto 20 mm (1/4 in) to brazing, hard soldering, bronze welding and heat-treating. Industrial/commercial uses include the repair and maintenance of motor vehicles, bicycles and agricultural machinery and equipment; work on steel erections at building and construction sites; in shipyards; and in heating, ventilating and plumbing installations. Other uses include rescuing accident victims from wreckage, and the makers believe that the equipment will also appeal to the handyman since it offers a relatively inexpensive means of carrying out a wide variety of repair and maintenance jobs in and around the home or farm.

The oxygen and acetylene cylinders are securely carried in the base of the trolley. They have a capacity sufficient for about eight hours of welding with a No. 2 nozzle and for cutting about 18m. of 6 mm mild steel.

Finished in epoxy resin for service under all conditions, the trolley incorporates a tool which holds all the components and accessories supplied, apart from components already assembled for use. The tool box lid has a useful quick-reference chart showing gas pressure required for various welding and cutting applications. Standard items include a welding and cutting torch,

cutting and welding attachments with five nozzles, a gas mixer, two regulators, two 2.5 m long 5 mm diameter hoses and a plastics tube holding different types of welding rods. Accessories include a battery-operated spark lighter; a pair of goggles, spanners and nozzle cleaners. An easy-to-follow instruction manual with additional welding and cutting information is also supplied with each set.

Address: BOC Ltd., West Pimbo, Skelmersdale, WNB 9QA, England.

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Industry Roundup

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

ELECTRICAL CABLES AND WIRES INDUSTRY

This industry in India is 50 years old and most of the types of cables which were being imported so far, are now being manufactured in India. Almost the entire requirement of power, industrial and domestic cables is presently being met indigenously.

Small scale sector occupies a very significant position in cables and wires industry in India. Most of the units of this industry accounts to small scale sector. A large part of small scale sector manufactures wires used for general house wiring.

Wires and cables industry is well established in India and only some special types of cables, like, oil filled cables required for special applications and super enamelled winding wires and above 42SWG are being imported. Wires and cables have been recognised as one of the key sectors of national importance. Cables and wires play an important role in Electrical Industry. They are the only media through which electrical power is carried from the sources to the equipment. Therefore proper care should be taken to improve the quality of cables and wires. To cater to the needs of electrical industry to fulfil their rigid specifications and higher temperature ratings, continuous upgrading of technology and use of modern machinery are of paramount importance.

The following P.V.C. and V.I.R. Cables for domestic use are exclusively reserved in the small scale sector.

1. A.A.C. (All Aluminium Conductor)
upto 19 strands
2. A.C.S.R. upto 19 strands
3. P.V.C. Wires of domestic type
4. V.I.R. Wires of domestic type

Wires and cable industry have been taken under the modernisation programme, as the machinery and the process of manufacture, followed are found to be out-dated. The machinery and the technology employed in the case of enamelled wire industry in the small scale sector dates back to the development of 1930s in the European Countries.

Types of Cables and Wires:

Technical Aspects

The term, electrical cables and wires industry generally includes four sections.

- a) Bare conductors mainly used for over-head transmission of electric power, such as, All Aluminium Conductors (AAC), Aluminium Conductors steel reinforced (ACSR), All Aluminium Alloy Conductors (AAAC) and grooved contact wires for railway traction, bus bars etc.
- b) P.V.C. and V.I.R. insulated cables and flexibles where generally each core carries current less than 10 amps. This category also includes domestic house wiring cables flexible connected with domestic appliances, control cables etc. P.V.C. cables are suitable for use where the combination of ambient

temperature and temperature raise due to a continuous load in the conductor does not exceeding 70°C.

P.V.C. Cables are of two grades:

- i) 250/440 volts
- ii) 650/1100 volts

The former grade cable is used for single phase and 3 phase systems where the voltage between each conductor and earth does not exceed 250 V. The 650 V/1100 V grade cables are suitable for the use on medium voltage, 3 phase system where the voltage between the conductor and earth does not exceed 650 V. These can also be used for single phase system in special conditions where greater degree of safety is required.

c) Power cables which are generally used for underground transmission and distribution of electric power mainly in metropolitan areas and large factories workshops and complexes. Traditionally these cables were paper insulated lead covered (PILC). But recently polyvinyl chloride (PVC) was introduced as insulating and sheathing material for cables upto 3.3 K.V. and in some cases 6.6 KV and 11 K.V. One of the recent development is cross linked polyethylene (XLPE) cables.

XLPE cable construction (single core, unarmoured): It consists of the following parts.

1. Stranded conductor (aluminium or copper)
2. Conductor shielding (consists of extruded semi conducting layer)
3. XLPE insulation
4. Semiconducting extruded layer over insulation (non-metallic part of the core shielding)

5. A copper or aluminium foil (metallic part of the core shielding)

6. P.V.C. Jacketing

d) Winding wires and strips. These include winding wires and enamelled/paper/fibreglass etc. covered strips and conductors. These products are mainly used as intermediate raw materials for electrical equipment such as motors, transformers, generators etc.

The above industries are covered under one single category probably because of the fact that the basic function of the products is to carry electric current and keep it restricted to a given path through usage of insulation covering it. Further there are common facilities in this industry.

The main facility being the availability of wire drawing equipment. Depending upon the end product additional varieties of equipment, such as stranding and shaping machines lapping and covering machines, PVC/lead sheathing machines etc. are added.

Background of Development:

From the early years, copper was used predominantly as electrical conductor. In all types of cables and wires (excepting AAC, ACSR, AAAC where the main conductor is Aluminium) copper still forms major cost component of the finished product. It is amazing to note that copper was used even for over head lines in early years. But it was replaced by Aluminium due to its high cost. Further, cost of copper fluctuates erratically depending on some predictable and unpredictable factors.

In majority of cases, manufacturers of cable and wire industry decided to utilise their expertise in procurement of various non-ferrous metals from international market by obtaining

collaboration and employing technical experts available in the country. Therefore, the origin of majority of large and medium scale cable units can be traced back to trading houses dealing in various non-ferrous metals or purchasing non-ferrous metals and producing traditional products.

Growth of the Industry:

There has been a tremendous progress in the field of cable and wire industry, design techniques calling for an ever growing need for better insulating materials in all types of service requirements. At present the industry is meeting almost the entire requirements of electrical and allied industries. Table I shows the production of conductors, cables and winding wires from 1974-75 to 1978-79.

Table I

Production of Conductors, Cables and Winding Wires

Particulars	Unit	1974-75	75-76	76-77	77-78	78-79
1. AAC/ACSR	MT	29,000	54,000	80,000	50,000	51,000
2. PVC & VIR Cables & Flexibles	Million Core Meters	580	420	570	530	565
3. PILC power cables (EXCL exports)	KM	1,870	1,870	2,494	2,559	2,960
4. PVC power cables	KM	11,600	11,600	13,000	12,800	13,700
5. Enamelled wires and strips	MT	15,000	14,000	15,500	17,000	20,000
6. Covered wired and strips	MT	4,500	5,000	5,500	6,500	7,000

Demand

As already mentioned, demand for the products of four sections arises from different considerations. They are remotely interlinked with the availability of power. Otherwise they are independent.

The main consumers/customers for overhead conductors are state electricity boards. The demand of PVC and VIR insulated cables and flexibles comprises the combined demand from several sectors. For example, the demand for domestic house wiring cables, depends on the new construction programmes, Rural Electrification Programmes (where electricity has been supplied), replacement of old wiring, since the life of domestic wiring is 15 to 20 years. The demand for controlling cables arises from activities in new industries, industrial complexes, railway signalling etc.

The demand for power cables arises from (a) underground transmission and distribution net works in metropolitan cities like Bombay, Madras etc. (b) electrical installation in various large industries, complexes such as steel mills, cement industry factories etc. and (c) generating, intermediate and receiving stations of supply net works. The life of power cables is generally long and therefore, replacement of the same is still not showing any visible impact. As a result, the progress of demand has not shown any remarkable performance. Further export of PILC cable is also contributing to some extent.

Motors, generators, automobile ancillaries etc. require winding wires and strips. The enamelled winding wires contribute to various types of fans, lower HP motors, chokes etc.

The demand for paper/fibre glass covered strips arises from the large HP motors, transformers etc. The replacement demand forms a small quantity since this is subjected to overloads leading to short circuiting faults.

Problems

Copper and aluminium are the most important raw materials of this industry. The country depends mainly on imports for meeting the requirement of copper. For several years, import of copper has been centralised through MMTC. While canalisation has led to increase in the cost of copper, it has also assisted the industry to some extent through price stability over a quarter. No doubt, the step of canalisation has effected the profitability of industry through opportune buying operations of copper.

Export

Electrical cable industry ranked as second largest exported product in the group of engineering exports. This is due to quality of products. The major items of export were power cables with aluminium/copper conductors and AAC and ACSR conductors. They are shown in table II.

Table II

Export Data

Sl. No.	Industry	FOB value in lakh rupees	
		1975-76	1976-77
1.	Insulated cables and wires	1547.16	1880.87
2.	Bare copper conductor	28.74	-
3.	Bare aluminium conductor	535.74	500.81

Future Scope of Cables and Wires Industry

AAC/ACSR

The fifth plan target aims at the demand for AAC/ACSR conductors by 1978-79 of the order 90,000 per annum. It is estimated that this demand may increase by 10% per annum during next five year period.

Having regard to the capacity already installed both in the large and small scale sectors, there is no scope for creation of additional capacity in this industry. The equipment required for this industry is indigenously available.

PVC/VIR Cables

There is no scope of creation of additional capacity in the industry, since these cables (used for house wiring) are reserved in small scale sector. And small quantity of specialised cables for high frequency and high temperature applications, which are at present being imported, can be taken by small scale units through diversifications. Similarly production of suppression cables is being encouraged in small scale units in order to minimise interference in communication from automobiles.

PVC/PILC & XLPE Cables (Power Cables)

As per the policies and programmes of Government, it is expected that the demand for power cables may increase substantially. For the manufacture of PILC cables substantial quantities of lead, tin, paper, cables impregnation compound of both draining and non-draining type and a few chemicals are required to be imported. As an import substitution measure the manufacture of XLPE

cable is encouraged by existing PILC cable manufacturers. Therefore most of the existing units have already taken steps to establish production facilities.

Manufacture of power cables with copper conductor is not encouraged unless it is for exports. Power cables used for domestic wiring are with Aluminium Conductors.

Winding Wires (Enamelled, Paper/Cotton/Silk/Glass Covered)

As the existing units are running below their capacity, there is no scope for setting up new units. But consideration on merits is made for diversification by existing units. Indigenous technical know-how is available for enamelled winding, and paper covered wire and strips. Except for fine wire drawing and enamelling equipment, most of the plant and machinery are available indigenously. Table III given below gives statistics regarding capacity and production targets.

Table III

Capacity and Production Targets

Sl. No.	Industry	Unit	1977-78		1982-83	
			Capacity	Estimated Production	Target Capacity	Target Production
1.	ACSR/AA	'000 tonnes	113.10	70.00	150.00	140.00
2.	PVC & VIR cables	Mill. Core Mtrs.	1281	470	1281	1000

(LKPC)

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Current Technical Literature

Copies of articles/documents listed in this section are available on payment of Rs.5/- for the first 5 pages or part thereof and Re.1/- for every subsequent page of the photocopy or xerox copy of the article/document. While placing the order, please mention the CTL Number of the SENDOC Bulletin.

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SECTION-IV

CURRENT TECHNICAL LITERATURE

RESOURCES

Energy Sources

159. AROKIASWAMY N S S: Energy alternatives for the rural power. Cable and Conductor News, 1979, 6(9), 9-12.

Outlines energy alternatives such as gohar gas plants, solar pumps, animal energy etc.

160. BUONAVENTURE P: Converting waste into methane. The Chemical Times, 1979, 6(13), 11.

Describes the process developed in Great Britain to produce methane by waste Conversion.(MSR)

161. MAKHAN D S: Biogas plants - problems and prospects. Fertiliser News, 1979, 24(4), 35-39.

Harnessing of manurial resources and providing renewable sources of energy in the villages would help conserve the fast depleting non-renewable sources of energy and, therefore, it assumes national importance and deserves adequate encouragement. It is suggested that the subsidy available on the installation of biogas plants should be enhanced and the interest rates charged over loans available from the commercial banks may be limited to only four per cent. Some suggestions have been given on the KVIC design and specifications and also for training of farmers in order to ensure a satisfactory operation of the bio-gas plants which will help their rapid multiplication in the countryside.

PAPER, PULP AND ITS PRODUCTS

- 162.-----: Ferro ammonium paper. The Chemical & Polymer Times, 1979, 7(4), 6.

Gives the details of manufacture of ferro ammonium papers, positive print papers, and negative print papers.(BS)

163. -----: Paper and paper board - An industry profile. Industrial Researcher, 1979, 5(4), 193-198.

Examines the growth of the paper industry in India and its problems since the beginning of the planning era.

164. ATTWOOD D: Paper & board from waste material. Paper print pack India, 1979, 17(7), 44-46 & 52.

Describes the process of utilisation of waste paper in manufacturing paper board.(BS)

165. DUNCAN D W: Waste paper recycling: the production of fine and speciality papers. TAPPI, 1979, 62(7), 31-33.

A waste paper plant supplied 90 metric tons/day of deinked, bleached fiber to three fine-paper machines running at speeds up to 520 m/min. White and coloured ledger and printed bleached kraft are batch-pulped then rough-screened and cleaned. This is followed by two stages of washing and two stages of bleaching, as well as fine screening and cleaning before thickneing. The stock, which has an Elrepho brightness of 79% has strength properties similar to those of bleached softwood sulfite pulp.

CHEMICAL INDUSTRIES

166. -----: Calcium silicide. *Chemical Industry News*, 1979, 23 (11), 901-902.

Suggests an economic unit of 100 tonnes of calcium silicide per annum giving details of demand, raw materials, equipment and economics.(BS)

167. -----: The progress of India's alkali industry during 1978. *Colour & Chemicals Weekly*, 1979, 5(19), 32-36.

168. KHARBANDA OP: Ammonium nitrate. *Chemical Weekly*, 1979, 24(25), 40-43.

Typical process flow chart and producers of ammonium nitrate are given. Use pattern, price production and trends in technology are briefly discussed.(MSR)

169. KHARBANDA O P: Ammonium phosphates. *Chemical Weekly*, 1979, 24(25), 44-47.

Typical process and technoeconomic details are briefly discussed. Names of manufacturers with their capacities are listed.(MSR)

170. KHARBANDA O P: Citric acid. *Chemical Weekly*, 1979, 24(27), 102-105.

Typical process, equations and materials involved in the production of citric acid are given briefly. Demand for the year 1982-83, use pattern, cost of the plant and producers with their capacities of citric acid are given. (MSB)

171. TRIVEDI D M: The Indian Chemical Industry at cross roads. Colour & Chemicals Weekly, 1979, 4(46), 41-43.

Traces out the development of chemical industry in India. Gives present status of the industry and presents problems faced by the industry at present.

Chemical Process Equipment

172. BHAT S G: Spray drying and its applications. Chemical Age of India, 1979, 30(11), 1009-1014.

Enumerates the advantages and disadvantages and operations involved in spray drying. Presents the design criteria and features of spray drying plant for detergents and other products.

173. CHAFFEKAR A: Improved performance of indigenous catalysts. Chemical Engineering World, 1979, 14(3), 47-52.

Reviews the performance of various indigenous catalysts giving statistics of imports, exports and indigenous production during the years 1975, 1976 and 1977.(BS)

174. HOLLAND F A: Heat pumps: Part I. The potential for heat pumps in India. Indian Chemical Engineer, 1979, 21(2), 2-8.

Discusses the principle of heat pump, existing systems, future developments, economics and potential for heat pumps in India.

175. MASTER S K: Recent developments in spray drying. Chemical Age of India, 1979, 30(11), 1017-1025.

Discusses the developments taking place in the field of spray dryer layout design in: (a) pollution free spray

drying; (b) dryer design for safe operation; (c) dryer layouts to improve thermal efficiency and reduce fuel consumption and (d) dryer operation to achieve improved product quality.

176. VISWANATHAN K V: Plate dryers. Chemical Age of India, 1979, 30(11), 1031-1033.

Highlights the principle of operation and design criteria of different models of plate driers which come under the category of contact dryers.

177. VISWANATHAN K V: Turbo tray dryers. Chemical Age of India, 1979, 30(11), 1035-1039.

Enumerates the advantages and highlights the method of operation of different types of turbo tray dryers.

DYES

178. -----: Profile of dyestuffs industry. Bombay Market, 1979, 42(16), 95-98.

Reviews the dyestuffs industry in India with import-export details and the scope for future development.(KLR)

179. MAHABAL B L: Recovery and reuse of materials from dyestuff industry. Colourage, 1979, 26(5), 23-24.

Describes the characteristics of wastes. Examines the possibilities of recovery of iron sludge, sulphuric acid, acetic acid and water.(SSD)

180. MEHTA M B: Scope for establishment of dyestuff industry in South India. Textile Dyer & Printer, 1980, 13(5), 29-30.

Reviews demand and supply of different classes of dyestuffs

and examines the scope of the development of the industry in South India in terms of raw materials availability, technology and manpower.(SS)

SOAPS AND DETERGENTS

181. -----: Can soap units in small-scale sector succeed? Colour and Chemical Weekly, 1979, 5(15), 29-31.

The capability of small scale sector for manufacturing soaps and allied products is discussed.(SSD)

182. -----: The fitting operation in soap making. Soap Perfumery & Cosmetics, 1979, 52(2), 67-69, 72-73.

The fitting operation is one of the most difficult parts of the soap-making process which has a significant bearing upon the quality of the resultant soap and its final yield. Some of the theoretical aspects in relation to their practical results are illustrated. One of the successful modern methods used for continuous fitting is briefly described.

(BS)

183. -----: Indian soap industry. The Chemical and Polymer Times, 1979, 7(2), 4.

An overview on the present status of Indian soap industry is presented.

184. -----: Manufacture of deglycerinised soap. The Chemical & Polymer Times, 1979, 7(2), 6.

A profile on the manufacture of deglycerinised soap is given. The total cost of the project is estimated at Rs.19,19,000/- for a STPD capacity plant.

185. OSTEROTH D: Toilet soaps. Soaps, Detergents & Toiletries Review, 1979, 9(8), 15-20.

Reviews the current state of soap technology beginning with its historical development.(KSDR)

186. PALMERI J A: Technology of detergent perfuming. Soaps, Detergents & Toiletries Review, 1979, (4), 23-25.

Highlights the technical problems encountered by the perfumer in creating a selling fragrance.(KSDR)

187. SACHDEV T R: Appropriate technology for the soap industry. Soaps, Detergents & Toiletries Review, 1979, 9(3), 23-25.

Describes the present status of the soap industry, characteristics of the organized versus small scale sector and beneficial effects of banning production of soaps and high density household detergents and scouring compounds in the organized sector (KSDR)

PLASTICS

188. -----: Industrial applications of PVC. Chemical Take-Off, 1979, 8(12), 15-22.

Gives the details of PVC manufacturing capacity in India. Mentions the chemical resistance offered by PVC to various chemicals and the use of PVC pipes in transportation of chemicals in USA. Highlights some of the industrial applications of PVC.(KSDR)

189. -----: Monoforming - a closed mould reinforced plastics production process. Reinforced Plastics, 1979, 23(1), 12-14.

Describes a process from an equipment manufacturer (the only

one so far) who has succeeded in improving the resin injection technique so that large components can be produced using light-weight moulds.(AA)

190. BHATTACHARYA G: Resin injection moulding - FRP moulding process. Popular Plastics, 1979, 24(1), X-XIII.

Describes the resin injection moulding process. Gives the comparison in working principles, advantages and drawbacks of the most important techniques for GRP production.(KSDR)

191. ESWAR H P: Fibreglass reinforced plastic equipment for chemical industry. Colour & Chemical Weekly, 1979, 5(4), 35-36.

Advantages, raw materials required, quality control, application and market growth are discussed briefly.(SSD)

192. KULKARNI M S: Energy economy for blow moulding. Colour & Chemicals Weekly, 1980, 5(51), 29-33.

Examines various areas of energy saving and thereby reducing the cost of production.(BS)

193. VENKATASUBRAMANIAN K N & CHATTERJEE B D: Developments in plastic processing. Chemical Weekly, 1979, 24(28), IPCL Supplement, 23-25.

Highlights a few of the outstanding problems of processing and reviews the developments in processing which have taken place in some of the major areas of plastic processing.(MSR)

PRINTING

194. MULLICK A B: Printing industry in India: present & future prospects. Paper Printpack India, 1979, 17(2), 42-44 & 47.

Highlights past pattern of growth, modernisation through technology and status of machinery and equipment.(BS)

195. PRATTE P F & MILLER D C: Quality graphic printing on corrugated board. TAPPI, 1979, 62(10), 91-94.

It is possible to print high quality graphics, i.e. line-tone, halftone, etc., on corrugated board with the flexographic printing process by controlling ink film thickness. This printing requires the right combination of anilox roll and rubber wipe roll and the use of the most appropriate printing plate material and ink. The TAPPI Printing Committee has just completed a study on the effect of these variables as they relate to quality of finished product. The results of this study are presented in this report.

196. SLOT W J: Developments in printing. Colourage, 1979, 26(23), 55-57.

An attempt is made to sketch the newest developments in the printing field in the last few years. The subjects taken up are: the rotary printing machine type RD-4-Airflow; the screen washing machine type SW-4; the flat bed printing machine type FMX; the steamers HS-2 140 and 600; and the polymerisation machine type PM-2 (AA)

ELECTRICAL INDUSTRIES

197. -----: The drawing of copper and aluminium wire for enamelling. Electrical India, 1979, 19(23), 5-10.

Presents modern approach to wire processing and enamelling with illustrative examples.(MVS)

198. BHANDARKAR G K: Protection of large induction motors. Electrical India, 1979, 19(5), 5-10.

The various types of protections to be considered for large induction motors are discussed. They include thermal protection of windings, short circuit protection, earth fault protection, etc.(LKPC)

199. LAD V K: Starting the A.C. motors. Electrical India, 1979, 19(12), 10-12.

Outlines different starting techniques used for starting squirrel cage motors.(LKPC)

200. LAD J K: The Superconductor. Electrical India, 1979, 19(5), 27, 29, 30.

Usage thermal and physical properties of superconductors are discussed with graphs.(LKPC)

201. LATHAM F & MEIR P F: Consumer safety with miniature circuit breakers. Electrical Equipment, 1979, 18(7), 29-32.

Describes advantages and operation of miniature circuit breaker. Graphs supplement the theory of operation.

202. PHADKE G M: Review of electrical industry. Electrical India, 1979, 19(3), 9-15.

Electrical industry has been reviewed giving various tables

showing the production of different commodities. The role of electrical industry, necessity of standardisation of electrical equipment, present status, future scope, etc are discussed.(LKPC)

203. TIWARI S N & TIWAR R N: Starters for D.C. motor. Electrical India, 1979, 19(5), 11-13.

Presents the state of the art in the development and application of D.C. shunt motor starters. A new simple and versatile solid-state starter is discussed and its suitability for various ratings is examined. A hybrid version of the starter may advantageously be employed for starting large industrial motors. The various laboratory tests and their findings are recorded and compared with the conventional three point starter. It is believed that several interesting features resulting from the hybrid scheme will be valuable in tackling the still unsolved problem of starting and accelerating the motors.(AA)

ELECTRONICS INDUSTRIES

204. -----: Report of the committee on magnetic tapes for professional applications. Electronics - Information and Planning, 1979, 6(8), 677-707.

205. CHARLES J: Electronic devices - Part VI. Electrical Equipment, 1979, 18(7), 60-65.

Describes various electronic devices, such as amplifiers of different types, integrated circuits LSI and MSI etc.

206. KOGA H: PC Board relays expand control applications. Journal of Electronic Engineering, 1979, (146), 28-30.

Discusses various PC board relays, such as input interface

relays, signal transmission relays, output interface relays which are employed for many rapidly expanding control applications. PC board relay configurations and specifications are given.(VVR)

207. MENDELSON A: Temperature transducers - what's cooking?

Electronic Products Magazine, 1979, 21(12), 51-

Describes temperature sensing devices covering both new semiconductor types and enhanced versions of traditional thermistors, thermocouples and RTDs.(VVR)

208. SINHA R: Development of Indian electronics industry. Bombay Market, 1979, 42(6), 79-88.

Reviews the situation of electronic industry in India with some statistical data.(KLR)

209. SUZUKI T: Fluorescent display tubes meet stringent application requirements.. Journal of Electronic Engineering, 1979, (145), 29-33.

Discusses the classifications and applications for fluorescent display tubes. Typical specifications for alphanumeric displays are given.(VVR)

210. TANAKA S: Simplified LF oscilloscopes enhance electronic advancements. Journal of Electronic Engineering, 1979, (147), 34-38.

Explains trends and applications of various oscilloscopes such as lightweight oscilloscope, programmable oscilloscope, multipurpose oscilloscope, video delayed trigger function oscilloscope etc.(VVR)

211. TRIPATHI R C: Contemporary quality of electronic components - A case study. Electronics - Information and Planning, 1979, 6(8), 726-750.

A case study has been made for general quality features of fixed film resistors produced in the organised sector and small scale units in India. They are compared in the quality requirements of relevant Indian Standards specifications and Joint Services specifications, and popular commercial and professional grade types.(AA)

212. WADA T: Liquid crystal research updates LCD technology, Journal of Electronic Engineering, 1979, (145), 38-41.

Discusses the research and development trends of present LCD applications such as in card calculator, mirror clock, calculator watch, bargraph display, character display unit TV etc. (VVR)

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SENDOC Services

Featured in this section are technical enquiries that were received and the services rendered by SENDOC during the month of March 1980. The charges for short technical enquiries will be Rs.5.00 to Rs.10.00 per typed page. Industry profiles already available with SENDOC are charged at the rate of Rs.10.00 each.

Sl.No.	Enquirer	Service Rendered
1.	DIC, Ongole, Andhra Pradesh	Profiles on: Acetic acid, Agar agar, Aluminium builders' hardware, Aluminium extrusions, Aluminium anodizing, Arc carbon, Badminton racket, Bicycle assembly, Bleaching, dyeing and screen printing, Breakfast cereals, Casette tape recorder, Cardboard slate, Cashewnut shell gum, Cassava processing, Castor oil dehydrated, Caster oil hydrogenated, Castor oil refined, Cement grinding media, Chappals or footwear, Chicory powder, Cheroot, China clay washery, Cigar, Clock electrical (dry cell type), Cloth - plastic coated, Coconut oil, Corn flakes (maize), Crayon chalk, Curry powder processing, Decorative articles from plastic sheets, Dehydrated onions, Detergent powder, Dolls, Papier mache', Electric washing machine (cloth drying), Electronic components (market survey), Extraction of oil from rosa grass, Fish dehydrated, Fish products, Jam, Katha, Mango processing, Papads, Phenol formaldehyde resin, Plastic tumbler, Plywood suitcase boxes, Printed circuit boards, PVC tiles and sheets, Reinforced plastics, Repair

shop for rewinding, Repellent cream mosquito, Repacking of medicines, Roofing tiles, Room cooler, Rope, Rural Fabric centre, Sago wrappers, Sand paper, Screen printing, Silvering of glass mirrors, Solid glass blades, spices processing, Splints and Veneers, Sports goods, Tape recorder, Tooth powder, Umbrella assembly unit, Voltage stabiliser, Vermiculate, Wall paper, Zip fasteners, Shuttle cocks.

2. DIC, Udhampur, Jammu and Kashmir

Profile on: Petroleum jelly

3. Ent. Andhra Pradesh

Profiles on: Bleaching powder, Absorbent cotton, Boot polish, Calcium carbonate, Synthetic adhesive (rubber based), Semi-mechanised brick unit, Roofing tiles, Carboxy methyl cellulose, Wire nails, Flooring tiles, Ether from alcohol, Polythene tubes and bags, Corrugated board box.

4. Ent. Bihar

Profiles on: Automobile gasket, Liquor ammonia, Deinking of paper.

5. Ent. Karnataka

Profiles on: Glass bangles, Mini rice mill, Paraffin wax, Aluminium rerolling mill, Aluminium utensils, Aluminium extruded parts, Aluminium sheets and circles, Aluminium notched bars, Aluminium water supply fittings.

6. Ent. Maharashtra

Profiles on: Oleoresin from chillies, Rubber goods, Gelatine capsules, Ceramic capacitors, Hydrated calcium Silicate, Fire bricks, Glazed wall tiles, Absolute alcohol.

7. Ent. Orissa

Profile on: Agar agar

8. Ent. Tamil Nadu

Profile on: Detergent cake

9. FI Bihar

Profile on: Leaf spring

SI - Andhra Pradesh	Profiles on: Brass lamp holders, Printed wax paper, Mangalore type tiles, PVC pipe and fittings, Ice making, Oleoresin from ginger and chillies, Board making, Glass bottles
SI - Bihar	Profiles on: Detergent cake, Detergent powder, Synthetic calcium silicate.
SI - Karnataka	Profiles on: Ballpoint pen refills, Agarbathies.
SI - Maharashtra	Profiles on: Pressure sensitive adhesive, Aluminium stearate, Automobile bush gun metal, Bandage cloth, Battery electrolyte, Cell rechargeable, Candles, Dairy farm, Dry cell, Electronic appliances, Elastic tape, Tartaric acid, Toy balloons, Lace, Paper napkin, Naphthalene balls, Monofilament yarn HDPE, Oil refining, Bricks, Dhal mill, Straw board.
SI - Madhya Pradesh	Profiles on: Aluminium utensils, Dairy farm, Detergent powder, Starch from potato, Cold storage.
SI - Orissa	Profile on: Distilled water.
SI - Uttar Pradesh	Profile on: Straw board.

Note: DIC - District Industries Centre
 Ent. - Entrepreneur, FI - Financial Institution
 SI - Small Industry.

How to obtain detailed information

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Rs. 5: for first 5 pages or part thereof.

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Hyderabad - 500 045 INDIA.

New Products and Processes

CHEMICAL INDUSTRIES

Benzyl Acetate, Benzyl Alcohol and Benzyl Benzoate

Esters like benzyl acetate and benzyl benzoate are widely used in perfumery industry. The bulk of benzyl acetate is used in soap industry as perfume. It is also a very popular chemical in other perfumery applications and is used to a minor extent in flavours. The oil obtained from Jasmine contains about 65% benzyl acetate.

Benzyl benzoate is extensively used in medicine and is an effective repellent for chigger, a tropical flea burrowing into skin. Benzyl benzoate is also used in perfumery industry and is particularly valuable as a fixative and as a solvent for synthetic musks.

Benzyl alcohol is greatly valued for the esters it forms with aliphatic and aromatic acids. The aliphatic esters are used principally by the soap, perfume and flavour industries. The good solvent properties of benzyl alcohol have made it very useful in the cosmetic, ink and lacquer industries. It readily dissolves casein and gelatine. It is an important ingredient in the preparation of certain acid resisting cements and resins. Solution of benzyl alcohol has found some use as a local anaesthetic. The pure alcohol has some antiseptic properties and in the form of an ointment or lotion, it is effective in relieving or preventing itching.

Regional Research Laboratory, Hyderabad has developed a process for the manufacture of benzyl acetate, benzyl alcohol, and benzyl benzoate, starting from toluene and chlorine. Toluene is first chlorinated under controlled conditions to benzyl chloride which on hydrolysis gives benzyl alcohol.

Benzyl esters are produced by reacting benzyl chloride with appropriate acid salts followed by fractionation of the crude product. The investigation was carried out on a scale of 25 kg per batch.

Toluene and chlorine are the main raw materials needed. These are easily available. The major items of equipment required for the process are reactor, steam distillation unit, rectification column, air compressors and boiler. All these are available indigenously.

It is estimated that a plant producing 84 tonnes of benzyl acetate, 42 tonnes of benzyl alcohol and 42 tonnes of benzyl benzoate per annum would require an investment of Rs.1.2 million, excluding land and buildings. About 25 persons would be required for the plant.

Phenylacetic Acid

Phenylacetic acid (PAA) is used in the manufacture of penicillin G and in perfumery industry. Data on the country's requirement for its use in the manufacture of penicillin G is not available. However, it is estimated that the total requirement may be over 150 tonnes/year. Few parties are reported to have undertaken production of this item in the country.

The National Chemical Laboratory, (NCL) Poona, has developed a process for production of phenylacetic acid starting from toluene as the raw material.

Chlorinated toluene is directly used to obtain benzyl cyanide, which is then hydrolysed to phenylacetic acid. The process has been standardized on a scale of 1 kg/batch of the finished product

All the raw materials such as toluene, chlorine, sodium hydroxide, sulphuric acid are indigenously available except sodium cyanide and a catalyst which will have to be imported. Sodium cyanide, however, is freely available to actual users.

Specifications of the product:

Colour	White
Melting Point	75 - 76°C.

The product conforms to the standards required by the antibiotic industry.

Hindustan Antibiotics Ltd., Pimpri, Poona and Indian Drugs & Pharmaceuticals Ltd., at Rishikesh are the main consumers of this compound. Their present requirement is about 140-150 tonnes/year, (about 70 tonnes each). Besides a few other firms who are also manufacturing penicilline G, may be using this compound. Phenylacetic acid is also used in perfumery industry. As such the actual demand for this item may be more.

The imports of PAA in the year 1969-70 were about 228 tonnes valued at Rs.24 lakhs and during 1970-71, 246 tonnes of PAA valued at Rs.26 lakhs were imported.

For a 60 tonnes per annum plant working on 3 shifts per day for 300 days, the fixed capital on plant, building and land is estimated at Rs.6.00 lakhs. The selling price of the product as per the NCL process, works out at Rs.13/kg. assuming 25% return on total capital for a 60 tonnes/year plant.

Premium: Rs. 10,000; Royalty: 1.5%; Nature of Licence :
Non-exclusive.

A New Reactive Adhesive for High-Strength Metal and Plastic Bonding

The Semi-Finished Plastic Products Sales Department of the Degussa Chemicals Division, Frankfurt am Main, has introduced Agomet F 310 to its range, a cold hardening reactive for metals and plastics which not only hardens rapidly but also develops exceptional tensile shear and anti-peeling strengths.

Agomet F 310 can be used without extensive pre-treatment of the components to be joined. The joint faces should merely be cleaned to remove loose impurities. Normal rolling or drawing oil traces are integrated by Agomet F 310 without difficulty, and can thus remain on the joint faces.

This new Degussa adhesive can be processed both by the "no-mix" method, using a hardener lacquer, with Hardener D via metering equipment or a hardener paste. The process time is some 5 to 8 minutes. After only 15 to 20 minutes, the bonded components are suitable for further processing. Ultimate strength is attained within 24 hours.

The adhesive application volume is satisfactorily low, at 150 to 250 g/m². Hardener lacquer need only be applied on one side for joint thicknesses of up to 0.4 mm. For thicker joints,

application on both sides is needed. For joint thicknesses exceeding 0.8 mm, only Hardener D or hardening paste should be used. The adhesive joints produced with Agomet F 310 are stable between temperatures of -40 and 130°C, and can withstand short term peak temperatures (up to 30 minutes at 180°C) without destruction of the adhesive bond.

For further details please contact: Degussa, Public Relations Dept., Postfach 2644, D-6000 Frankfurt 1.

ELECTRONICS AND ELECTRICAL INDUSTRIES

Filament Winding Machine

Fibreglass reinforced plastics are lightweight materials but they have very good mechanical and electrical properties. Also they have excellent resistance to corrosion by chemicals. Based on these special features, the FRP material is widely used for making components in the field of aeronautics, space, electrical, chemical and allied industries. The method for manufacturing these components usually involves a filament winding machine. The National Aeronautical Laboratory (NAL), Bangalore has developed the know-how for the manufacture of such winding machines, the design of which has been patented. A few winding machines, made as per the NAL design, have been field-tested and found to possess good performance.

Filament winding is a process by which glass or metal in a continuous filament form and a compatible polymer are combined to make a reinforced plastics structure. The presently developed winding machine carries out the winding operation in an efficient way. The main elements of the machine are: A mandrel drive

system; A feeder drive system; and associated electrical circuits for starting and stopping the above drive systems.

There is also an electrical coupling for simultaneous stopping and starting of the two drive systems. The mandrel drive system has a three phase electric motor, a reduction gear box, a mandrel mount etc. for obtaining different mandrel speeds. The feed drive system consists of an electric motor, a level-operated gear box, a feeder carriage, a screw rod to facilitate feeder carriage reciprocation, motion limit switches, safety limits and a roving delivery system.

Wetting system provides a regulated feed of resin on to the fibreglass roving during the winding process. Suitable squeeze rollers are used to secure uniform wetting and to control the resin content.

The assembly comprises a superstructure on which are mounted a fibreglass roving mount with a variable speed drive for adjusting the fibre tension, a resin wetting system including an excess resin remover, a precuring chamber, a tension adjusting pulley, a tension measuring device, a fume duct, a console for electrical circuitry etc.

The broad specifications of the filament winding machine are given below:-

1.	Maxi diameter	140 mm
2.	Min. Diameter	25 mm
3.	Max. length	750 mm
4.	Winding angle	30° Helix to 89° circumference
5.	No. of mandrel speeds	8
6.	Max. feeder speed	3.1 M/Min.
7.	Min. feeder speed	0.47 M/Min.

NAL, Bangalore has fabricated a number of winding machines and have supplied them to different organisations. Their performance have been found to be excellent.

No market survey has been conducted, but due to the huge application potential of FRP in different industries like chemical, electrical etc., the demand for this machine is expected to be significantly high.

The main equipment required for the manufacture of these machines are gear head lathe, drilling machine, cutting machine, grinding machine, welding set etc. All are available indigenously. The main raw materials/parts needed for manufacturing the winding machine are: reduction gear box, electric motor, gear lathe, contactors, push button switches and other hardware items.

The total fixed capital has been estimated at Rs.1.6 lakhs excluding the cost of land and building. The cost of production has been estimated at Rs.30,000/- per machine, while similar imported machine will cost about Rs.80,000.

Tentative terms for know how transfer: Lump sum premium Rs.16,000; Recurring Royalty 3%; Period of licence 7 years; Nature of licence - Non exclusive.

Radio Frequency Furnaces and Heaters

Induction furnaces provide an important method of heat-treatment for precise and controlled heating of the components and could also be utilised for melting of metal filings, sintering, seam welding, etc. The furnace works on the principle of skin effect and operates at high frequencies.

Central Electronics Engineering Research Institute, Pilani has developed two types of induction furnaces. The first model provides a maximum of 1.2 kw rf power at a frequency of about 13 Mhz. The unit is compact, portable, selfcontained and reliable. It will be useful in the metallurgical laboratories, industries, commercial laboratories, universities, etc. The performance of the model has been found to be quite satisfactory. The iron drilling samples attain a temperature of 1500°C within a short time of five seconds.

The second model is mainly meant for heat treatment applications and can also be used for zone refining, glass to metal sealing, crystal growing, high temperature plasma, etc. It can develop a maximum of 5 kw rf power at a frequency of one Mhz. A prototype made has been used for many in-house trials for one year successfully.

Since the manufacture and use of induction furnace involves generation of high R.F. signals,,it is necessary that relevant frequency regulations of the country are complied with by the manufacturers and by the users.

Specifications:

1. 1.2 KW RF. furnace	: 220 V $\pm$ 5%, A.C. 50 Hz, Single phase
Power supply	: 2.0 kW at max. output : 0.16 kW at standby
Power Consumption	: 1.2 kW at 13.56 MHZ (Nominal)
Dimensions	: 6.7 cm High x 4.6 cm Wide x 52 cm. deep.

2. 5 KW RF furnace:

Power input	: 10 kVA, 440V, 3 phase, 50 Hz
Power output	: 5 kW at 1 MHZ (Nominal)
Frequency	: 800 KHZ at no load 1200 KHZ at full load.

The raw materials required for the manufacture of these furnaces are power transmitting tubes, rectifying tubes, 5v transformers, meters, relays, switches, contactors, circuit breakers, exhaust fans, resistors, capacitors, etc. All the items, except the high voltage capacitors, are indigenously available. The main equipment needed are lathe, drilling machine, shearing machine, grinding machine, fly press, gas welder, hand tools, universal bridge, oscilloscope, rf watt meter, and multi-meters.

At present the items are being mostly imported, though a few indigenous manufacturers have entered the field. The demand is expected to be considerable, but a proper market survey has not been made so far.

The capital investment needed to manufacture 20 units of the 1.2 kw model and 4 units of the 5 kw model is estimated at Rs.2.25 lakhs (fixed capital, excluding land and building Rs.1.00 lakh; working capital Rs.1.25 lakhs). Depending upon the product mix, the working capital requirement will vary.

Terms of know-how transfer:

Lumpsum premium	: Rs.15,000 (for both type) : Rs.10,000 (for either type)
Recurring royalty	: 3% on sales
Period of licence	: 7 years
Nature of licence	: Non-exclusive.

Sequential Temperature Programmer

The National Aeronautical Laboratory, Bangalore has developed a device to be used for sequential programmable variation of temperature with any temperature regulator. It can work under highly noisy industrial environment.

The programmer comprises four main blocks - variable clock generator, frequency divider, stage selector, and stepper motor with translator. The variable clock generator is used to achieve different rates of change (increase or decrease) of temperature. The setting is provided by a rotary switch in the front panel with 10 setting positions. The clock frequency is divided suitably to achieve long time delay with a uniselector switch which is an electro-mechanical device and hence has very high noise immunity. This clock, divided in 3 or 4 steps depending on the total delay required, goes through the stage selector which selects the direction of rotation of the stepper motor; in other words, it decides whether the temperature has to increase or decrease at the set rate.

The programmer works in four stages: In the first stage the temperature increases as per the set rate; in the second stage, it stays at the maximum set temperature for a set period; in the third stage it decreases again at the same set rate to the set temperature; and in the final stage it remains at the minimum temperature for the set period. The stages can be increased beyond four. The translator gets the signal from the frequency divider step through the stage selector, and the stepper motor turns accordingly. This can be connected to any temperature controller whose temperature is set by a potentiometer knob.

The main equipment required in the manufacture of the programmer are hand-drill sheet metal shearing and bending machine, multimeter and stop watch, all of which are indigenously available. The main raw materials/components required for its production are semi-conductor devices, stepper motor, uniselector, thumb wheel switches, 3-position switches, on-off switch, lamp, start switch, stop switch, clock selector, fuse and fuse holder, power supply (35 v, 2A, unregulated), external clock input socket, external clock input switch, external stage change-over input socket, resistors and capacitors. All these items are indigenously available.

Total capital investment required to set up a plant producing 35 programmer unit/yr. is estimated at Rs.50,000. The cost of production works out to Rs.3,000 per unit.

METALLURGICAL INDUSTRIES

Filler Wires for Aluminium Alloy Welding

Sound and defect-free welding of high-strength aluminium alloys with the welded region possessing adequate mechanical and physical properties comparable with those of the parent metal is an important aspect of the technology of fabrication of aluminium alloys for construction and this is achieved through the use of filler wires of specified compositions.

The properties generally required in the welded regions of aluminium alloys are: (i) the welded joint or fusion zone should be free from cracks, and (ii) the strength (28 kg/mm^2), corrosion, and other properties of the weld metal should match those of the parent metal. The properties of the weld metals are mainly

governed by the chemical composition of that region which in turn is controlled by the composition of the parent metal, filler wire and the proportion of the wire in the weld metal.

The nominal composition of most grades of these filler wires is described in the various national standards, but their production technologies need to be developed to suit the indigenous resources. Developmental work was, therefore, initiated at the National Metallurgical Laboratory (NML), Jamshedpur, on (i) aluminium 5% Mg filler wires/rods corresponding to BS:2901 NG6 and IS:1278, 1972 NG6 and (ii) aluminium alloy filler wire corresponding to HAL specification MS RR.9500/34.

The melting, solidification and processing technology of these filler wires, designated as NML-PM6 and NML-PM7 welding filler wires for aluminium alloy welding, was developed and performance of these filler wires was evaluated at the Hindustan Aeronautics Ltd. (HAL), Bangalore. Industrial trials of these products confirmed their suitability for welding high-strength aluminium alloys. NML has since been producing these filler wires to meet the requirements of HAL.

NML-PM6/NML-PM7 welding filler wires find wide applications in various civil and defence establishments where high/medium strength aluminium alloys are in use.

NML-PM6 filler wires find applications in welding of sheet metal components, welding of sheet to tube joints, welding of forged machined blades and casting assemblies, and in weld corrections of castings.

Some of the typical applications of NML-PM7 filler wires are in the repair of sealing ring/sealing face for wear/fretting

by weld build of material and machine to restore drawing requirements, repair of broken bolt lug by welding, reclamation of fretted flanges by weld build of material and machine to size; repair of worn bearing abutment face when fretted by welding and machining to restore drawing dimensions; repair of diffuser back plate outer/inner rim location by welding and machining to standard dimensions; and repair of cracks on castings.

Submerged Arc Welding Fluxes

Welding fluxes are especially suitable for welding light to heavy structural steels and high-pressure vessels by submerged arc welding. During welding the bare electrodes are immersed in a loose granular flux placed on metal joints to be welded and the arc is struck beneath the bed of flux. Due to the high temperature of the arc, the flux surrounding the arc melts. This molten flux layer acts as a protective coating over the welded joint and prevents the weld metal from being exposed to the atmospheric gases which can cause detrimental porosity and other structural defects.

Several types of welding fluxes are produced indigenously. However, their present production falls short of the demand. A large quantity of fluxes are still being imported. NML, Jamshedpur has developed a few improved types of fluxes containing high manganese dioxide. The welding fluxes developed are substantially non-crystalline and amorphous products. Several welding fluxes having compositions suitable for sub-merged arc welding, especially heavy structural and pressure vessels, have been developed.

Raw materials are crushed in a jaw crusher, powdered in a disintegrator and stored in bins. Different ingredients are weighed and mixed in the desired proportion. The mix is melted

and the molten mass is quenched. The material is then ground, sized and dried before packing.

The process has been studied on a laboratory scale, and the product obtained has been found satisfactory.

The raw materials required for the manufacture of fluxes are manganese ore, fluorspar, dolomite, limestone, magnesite, bauxite, chrome oxide, china clay, alumina, sodium aluminium flouride, chromite, molybdenite, rutile, silica, sand, quartz, quartzite, iron ore, felspar, serpentine, granulated blast furnace slag, coke. Most of these are available indigenously.

Jaw crusher, roll mill, pulverizer, melting furnace, quenching tank, drier are the main items of equipment needed. All these are available indigenously.

It is estimated that a plant having a capacity to produce 300 tonnes of fluxes per annum would need an investment of Rs.0.6 million, excluding land and buildings. This plant can employ about twenty persons.

TEXTILE INDUSTRY

Foam Finishing Technology Package

Union Carbide Corporation and Gaston County Dyeing Machine Company have announced the signing of a new agreement whereby Gaston County now will be able to offer a complete FFT Foam Finishing Technology package to prospective textile manufacturer customers.

Gaston County manufactures the FFT Foam Application System which employs a new process developed by Union Carbide for applying concentrated chemical solutions to porous substrates at wet pick-up levels as low as 10%.

With the purchase of a foam applications system from Gaston County, the purchaser will obtain the right to perform the FFT process and apply the formulations patented by Union Carbide Corporation. There will be no obligation to pay running royalties to Union Carbide.

Gaston County will provide each FFT System purchaser with the technology to produce his own foam formulations and apply them to fabrics. Formulations with required foam and flow characteristics can be developed to apply most water soluble or water dispersible chemicals. Recommended chemicals will be described in generic terms whenever possible so they may be purchased from the most advantageous source.

In addition to its usual installation and start-up assistance, Gaston County will provide a short orientation program in FFT technology for each purchaser.

Gaston County also will provide under a non-disclosure agreement, foam formulation technology to manufacturers of chemicals and dyestuffs serving FFT system purchasers. The non-disclosure agreement merely limits use of the confidential information to the development of chemicals and formulations for application on FFT systems purchased from Gaston County.

To aid FFT development work, Gaston County now is offering a 20" laboratory applicator unit. This is supplied complete with foamer, applicator, the same process controls as the production

unit, and devices for cloth let-off and roll up. Further details from: Gaston County Dyeing Machine Company, Box 308, Stanley, North Carolina 28164, U.S.A.

Printing on Wool

The technique of pigment printing of textiles, now very well established for cotton and cotton-polyester fabrics, offers a cheap way of producing coloured designs that resist fading.

The approach differs from conventional printing in that the coloured pigment, which is insoluble in water, is mixed in a resin and then printed on the fabric. Heating the fabric cures the resin, forming a film that holds the pigment on the fibres.

However, the pigment-printing resins currently available are unsatisfactory for wool. The prints produced have poor resistance to rubbing and the fabric feels very harsh.

Scientists at the CSIRO Division of Textile Industry have now overcome these problems with the development of a new pigment-resin formulation. The formulation is made up of pigment, polymeric binder, cross-linking agent, curing catalyst, and thickener. The components are all readily available proprietary products.

To maximize the depth of colour of the prints and their resistance to rubbing, the wool is chlorinated before printing. The formulation is then printed on the fabric using conventional flat-or rotary-screen equipment. The fabric is then heated for several minutes to cure the resin. This forms the coating which holds the pigments on the fabric.

The new formulation gives prints that have good resistance to rubbing and has little effect on the feel of the fabric.

A wide range of colours can be printed, and all have superior resistance to fading, making the formulation ideally suited to application to curtain materials.

The scientists are continuing their research to improve the printing of wool. In particular, they are investigating a technique called transfer printing. This involves printing a design or motif on paper and then, at a later stage, transferring the design to the textile by hot pressing.

The advantages offered by the transfer printing process are considerable. Mistakes made during printing on to paper are far less expensive than when fabric is being printed directly. The complex printing procedures are left to the paper printers and the textile mills perform only the relatively simple transfer step. Other advantages are that printed paper has a lower inventory cost than fabric and the transfer equipment is much cheaper than a textile printing machine.

Two techniques of transfer printing are being investigated. In the first, melt transfer printing, conventional wool dyes are mixed with a resin or similar material and printed on the paper. When the paper is heated in contact with the textile, the resin melts and transfers the design to the fabric. Subsequent steaming of the fabric causes the dye to transfer from the resin to the fibre.

The second technique, sublimation transfer printing, has grown in use since the late 1960s, especially for polyester. A feature of the technique is that when the paper is heated in

contact with the textile, the dyes sublime and transfer to the textile in the form of a vapour.

Unfortunately, most dyes that are sufficiently volatile to be transferred in this way have little attraction for wool - they pass straight through the fabric or, if not, they readily wash out.

The scientists are investigating treatments to increase wool's attraction and holding power for the dyes. As well, they are hoping to produce a new dye that will sublime, yet which will possess chemical groupings that will make it resistant to washing off once on the fibre.

Both the melt transfer method and the sublimation transfer method are still being investigated and refined, but they have great potential for becoming the cheapest and simplest methods for printing designs on wool. The printing paste recipe and preparation details are given in Report No.G35- A method for the pigment printing of wool fabric, available from CSIRO Division of Textile Industry, P.O. Box 21, Belmont, Vic.3216, Australia.

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New Machinery and Equipment

CONSTRUCTION MACHINERY

Block Making Machine

A compact block making machine introduced by a British firm enables concrete building blocks to be produced on site, eliminating the risk of breakages which can occur when blocks are transported. Production rates for a typical 100 mm wide block can be as high as 320/h.

Known as the Corpblok M 2, the machine is designed for small to medium sized block making operations and is available in electric motor or diesel versions rated continuous 24 hour operation, if required. It can produce blocks ranging from 390 mm to 460 mm long; 180 mm to 230 mm high and 50 to 220 wide.

The number of blocks which can be made in one operation depends on block width and the maximum casting width of the mould box (906 mm) plus a width allowance of 6 mm per division plate (the plate that separates blocks in the mould box).

Power units and block making components are mounted on a sturdy steel chassis incorporating four heavy duty solid rubber tyred wheels. The machine's compact dimensions - only 1.80 m long x 1.32 m wide x 780 mm high for the electrically powered version - make it highly manoeuvrable on site and easy to transport to and from site. Respective weights are 880 kg. (electric version) and 950 kg. (diesel version).

Operating and maintaining the machine are simple procedures, requiring little training. The concrete mix is placed on a feed tray and fed into the mould box with a hand rake. A foot-operated switch provides a short burst of vibration to settle the mix in the moulds. The carriage containing the tamper is rolled forwards until it contacts guide columns on either side, ensuring that the tamper head is correctly aligned with the mould box. The handle used to roll the tamper carriage forwards is then released, enabling the tamper to drop a short distance into the mould by its own weight. During a second burst of vibration to further consolidate the concrete mix, the tamper descends further into the mould unit; it meets stops which have been pre-set to determine the required height of the blocks within the mould.

Formed blocks are ejected by pulling the mould box handle, this lifts the box clear while the tamper holds the blocks on the ground. Further raising of the mould box causes the tamper also to be lifted. The machine is then moved forwards to the short pre-determined distance, leaving the freshly made blocks behind to dry. This forward movement is performed automatically (forward indexing) by a 0.37 kW motor in the case of the electrically-operated machine and manually in the case of the diesel version. Vibration for the respective versions is provided by a 0.75 kW motor and an air-cooled diesel engine developing 3000 rev/min.

To repeat the block making cycle the operator lowers the mould box to ground level and pushes the tamper carriage back to provide access for refilling the moulds.

An outstanding feature of the machine is the provision of rubber mounts to isolate the mould and tamper units from the

machine's frame, providing maximum concentration of the vibration/compaction forces into the concrete mix.

Details: Coronet EM Ltd., Long Furrow, East Goscote Industrial Estate, Leicester, LE7 8 XJ, England.

Compact Block Making Machines

Compact have released details of various capacity block making machines designed for sizes ranging from tiles of 6 x 20 x 40 cm to blocks of 30 x 25 x 50 cm. The machines range from the hand operated model having a daily output rate in 8 hours with 2 workers from 500 to 600 operations, to the semi-automatic model having a daily output rate of 1000 to 1100 operations under the same conditions.

Model 43M is a hand-operated mechanical block making machine in which the worker fills the mould with concrete with a shovel, after which it is pressed in by vibration. The mould is stripped with the help of a lever. Daily output on a 8-hour shift can range upto 600 operations. The size of blocks produced can be upto 30 x 20 x 40 cm. This model can be powered by either a 1.5 hp electric motor or a 6 hp diesel engine.

Model 5M is a semi-automatic one with hydraulic stripping having a daily output rate of upto 1100 operations in a 8 hour shift. Size of blocks produced is 30 x 50 x 25 cms. This model is powered by two electric motors, one 1.5 hp motor for vibration and one 3 hp motor for the hydraulic set.

Model 66M has an oleo-dynamic operation through two hand levers. Its output in a 8 hour shift is upto 800 strippings. Sizes of block produced are upto 60 x 60 x h cm where $h = 25$ cm,

35 cm or 50 cm. This model can be powered by a 12.5 hp diesel engine or two electric motors, one 2.7 hp motor for vibration and a 5 hp motor for the hydraulic set.

Further details of all models can be obtained from Compact Spa, 20011 Corbetta, Milano, Italy.

ELECTRONICS AND ELECTRICAL EQUIPMENT

Heavy Duty 'Xtena'

M/s. Automation have now introduced yet another model - the new heavy duty model of 'Xtena' the extension cord box. This heavy duty Xtena with iron clad plug and socket is a moving power point which serves as a portable socket for all temporary connections in factories, workshops and similar other places, when there is no plug point nearby. It is housed in a sheet metal cabinet with heavy duty spool and is provided with a handle for easy winding. Heavy duty 'Xtena' is available in 3 different models - with 10 amps. socket (model 201), and with 15 amps socket (Model 202), both with 3 core, 15 meters copper cable, single phase. Model 203 has 20 amps socket with 4 core, 10 meters copper cable, 3 phase.

This model is most indispensable for various portable machine tools used in a workshop, industry and institute such as Welders, Drills, Grinders, Vacuum cleaners, etc. It dispenses with unnecessary and cumbersome wiring in different places of the factory and workshop which often causes accidents.

Further details can be obtained from: M/s. Automation, 132 A, Dr. Annie Besant Road, Worli Naka, Bombay-400 018.

Low-Cost Frequency Counters

Use of CMOS 1st circuitry and a one-chip microprocessor has the cost of two new frequency counters, according to Philips Test and Measuring Instruments. The 120 MHz PM 6667 and 1 GHz PM 6668 provide high resolution, 15 mV sensitivity and auto triggering on all wave forms.

A choice of two measuring times is provided-either normal with seven-digit resolution every second or fast mode with six-digit resolution every 200 ms. Display is on a clear high contrast liquid crystal display.

High resolution is obtained by making multiple period measurements and computing the reciprocal value. The microprocessor eliminates the tradition 1 cycle error and avoids the need for long gate times or period measurements or the limitations of phase-locked frequency multipliers.

High stability is provided by a standard crystal oscillator - ageing is less than 5×10^{-7} month. For higher stabilities a temperature-compensated crystal oscillator is available with ageing less than 1×10^{-7} month. An external 10 MHz reference can also be used.

The auto-trigger facility sets the trigger level automatically to the input waveform with no knob twiddling even for low duty cycle pulses. In addition, the 1 GHz model has automatic PIN diode attenuation providing high overload tolerances.

Much effort has been put into the design of the front-end circuitry for accurate and easy triggering. A multistep attenuator gives a noise immunity on input signals upto 10 dB better than with a standard times-ten attenuator.

The low component count increases instrument reliability. Self-diagnosis facilities are built in to the microprocessor to perform complete functional block tests at every power on-errors are indicated on the display.

The counters are packed in rugged, high temperature and impact resistance polyphenylenoxide cases with full screening against electromagnetic interference. The instruments run on 115 or 230 v ac $\pm 15\%$ at 50 to 60 HZ or from an optional internal battery pack providing for up to five hours continuous use.

Details: S & I department, Pelco Electronics and Electricals Limited, Shivsagar Estate, Block 'A' Worli, Bombay-400 018.

Portable Flow Indicator

A pocket-sized battery operated flow indicator with built-in sensor and digital read-out is now available from Quintor Electronics, Reedham House, Britwell Rd., Eurnham, Bucks, England.

The instrument, known as the Digiflow, does not require ranging and the operator need only press a centrally mounted button switch on the front of the unit to obtain a reading. A calibration chart is fixed to the back panel providing correction factors for different types of materials. The sensor at one end of the instrument held against the outside of pipework will present a flow rate read-out in approximately three seconds on a digital display which is calibrated in feet per second.

The Digiflow is suitable for use on dirty liquids and slurries which contain entrained air bubbles or particle contaminants.

An industrial version for permanent installation, either mains or battery operated, is available. This version has the sensor external to the unit and again the operator presses a button switch to read the flow rate as and when required. The mains operated model can give a continuous read-out and supplies a 4-20 mA signal output with the additional option for a flow failure signal with a pre-determined alarm set point.

ENGINEERING EQUIPMENT

Moisture Meter

Believed to be the smallest of its kind in the world, a battery-powered precision moisture meter developed by a British firm for timber and other building materials measures only 150 mm long x 65 mm wide x 25 mm deep and weighs a mere 130 g. It fits easily into the palm of one hand and when not in use, can be carried in a jacket pocket or attached (in its protective pouch) to a belt.

Known as the Timber Mini, it provides an instant percentage reading of the moisture content of timber during conversion and at all subsequent stages, from woodyard and saw mill to joinery shop. Alternatively, the instrument can be used by surveyors, architects, builders, painters and contractors to measure the degree of moisture in other moisture-absorbing building materials such as plaster, concrete and brick.

High accuracy is maintained by the incorporation of advanced micro-circuitry which also accounts for the instrument's compact size. The meter is powered by two standard 9V batteries and has a tough plastics casing designed to withstand rigorous on site operating conditions.

For normal use, the instrument incorporates two contact pins (electrodes) which are simply pressed into the surface to be tested. For readings at locations with limited access, an optional cable incorporating a two-pin head can be supplied. This plugs into a socket on the instrument which also accepts two other types of optional probes.

The first is a hammer electrode (an electrode incorporating a movable weight which acts as a hammer) for use either on woods which are difficult to penetrate or on woods of any type when it is required to obtain a below-surface moisture reading independent of surface wetness. The latter application is made possible by the insulated shafts of the hammer electrode's two pins.

The second type of probe is a deep wall unit with two 305-mm long electrodes for measuring below-surface moisture conditions of walls regardless of surface conditions.

Instead of using a pointer and scale, as used in larger instruments, the Timber Mini incorporates a row of 16 lights (light-emitting bodies), 15 of which provide percentage moisture readings for timber over a scale ranging from nine per cent to 28 per cent inclusive. The lowest (16th) light is the 'on' light.

When the probes contact timber and a button is pressed, a light corresponding to the nearest percentage moisture content will appear. When the instrument is used on other building materials, such as plaster, concrete or brick, a light indicating the relative dryness/dampness of the material appears against a three section colourcoded scale running parallel to the row of lights. A light appearing within the green section indicates 'safe', within the shaded section 'investigate' and within the red section 'remedial action needed'.

Manufacturers: Protimeter Ltd., Meter House, Fieldhouse Lane, Marlow Buckinghamshire SL7 1LX, England.

Motorised Hardness Tester

Fine Engineering Industries, MIDC, Miraj, Maharashtra has developed a motorised hardness testing machine which is provided with the fractional HP electric motor and cam arrangement. The main purpose of this type of machine is to eliminate the human error and to increase the production. This motorised conversion of manually operated hardness tester increases the speed of the testing without loss of accuracy as the major load removal in the test cycle is automatic.

Though the bench type hardness tester can meet the demand for mass producing testing at the big factories and inspection shops. The repeatability of the readings from operator to operator is fairly accurate because of elimination of human error. In case of power failure, the machine can be used manually.

Omikron Rolling Gear Tester

The Omikron Rolling Gear Tester manufactured by Kala Silk Engineering Pvt. Ltd., is capable of measuring composite radial variation and tooth to tooth radial variation of spur and helical gears. The other gears can be tested with the help of special holding fixtures.

The gears are tested by rotating under tight spring pressure against a high quality master gear. The variation in centre distance due to rotation and spring pressure causes displacement of floating arm and it reflects on the accurate dial indicator showing exact amount of displacement.

Due to intermittent cutting characteristics of gear generation process, the tooth profile of the gear gives certain deviation from the true and smooth involute profile. This error is reflected in the dial indicator when each tooth of the gear being tested is engaged and then disengaged with the master. Backlash is determined by deviation from standard centre distance between test gear and master gear of known dimension.

The tester has the following advantages: The gear is tested around full circle and errors affecting backlash are measured; Composite gear checking allows reliable sorting before assembly or despatch and eliminates faulty gears in time; the use of Rolling Gear Tester during machine set up is inevitable as the set can be rectified before starting production; Damage in the tooth flank show excessive flick on the dial indicator and can be easily located for rectification.

Capacity

Centre distance - 20 mm - 130 mm (0.8" - 5.125")

Suitable for gears - 0.4 mod (64 DP) - 2 mod (12 DP)

Maximum weight on

Adjustable slide - 5 kgs.

Maximum weight on

Arm - 2.5 kgs

For further information, please contact: Kala Silk Engg.Pvt.Ltd.
53, 54 Veena Dalvai Industrial Estate, 5, Vivekanand Road,
Oshiwara, Jogeshwari, Bombay-400 060.

Screw Compressors

A new line of screw compressors, providing excellent operational flexibility with low maintenance, has been introduced by Frick Company, USA. Frick has designed its new RWB Screw Compressor line with continuously variable capacity control from 10 per cent to full automatic or manual capacity, offering significant savings in energy costs.

Additionally, the new Frick RWB Screw Compressors have pressure controls isolated from electrical and load-limiting controls to provide maximum system protection without constant watchdog monitoring. Components have been placed for convenient access and low-cost maintenance. Piping, too, has been minimized.

The Frick RWB Screw Compressors are refrigerant compressors for applications using NH_3 , R12, R-22, and Propane as standard refrigerants. Other refrigerants can be used with modifications to the unit. They range in capacity from 278 CFM to 333 CFM Swept volume.

The compressor and motor are mounted on the oil separator shell which, in turn, is supported on ductile iron mounting bases. Oil pump, filters, piping, and isolating valves are mounted underneath the shell. Dimensions for the line of compressors, depending on capacity, range from 4 1/2 feet to 6 feet wide, 13 1/2 feet to 16 feet long, and 8 feet high.

Within the compressor configuration, there is a horizontal, three-stage oil separator with integral sump. The first stage consists of impingement, change of direction and reduction in velocity. The second stage is a large settling chamber and the third stage utilizes coalescing elements to filter out oil smoke

through a manhole in one end of the separator. Integral sump contains a tubular oil heater that is renewable without compressor shutdown and two bullseyes to permit monitoring of proper oil level. The oil pump is a positive displacement type connected directly to its own drive and mounted so it is completely accessible and serviceable. The pump operates independently of the compressor and starts up long enough before the compressor to insure prelubrication of the screw and full opening of the slide valve. Also, the oil is water cooled through a heat exchanger.

Two separate control panels are utilised for pressure controls and electrical controls respectively meeting NEMA-12 specifications. Both are factory wired and mounted. All controls are accessible for ease of operation and maintenance.

For more information on the TWB Screw Compressors, contact: Frick Company, Waynesboro, Pennsylvania, USA.

METALLURGICAL EQUIPMENT

CO₂/MIG Welding

Continued efforts by the technologists and engineers to combine speed and economy in one process has paved way to the invention of CO₂/MIG welding process. Carbondioxide welding is also known as Metal Active Gas (MAG) welding in which the necessary thermal energy-required to melt the base and filler materials is provided by an arc struck between a consumable electrode and the workpiece, the arc being shielded by CO₂ gas. The process became the first economical semi-automatic welding process for welding of steel.

"KEARC" CO₂/MIG welding outfit consists of control box, wire feed unit, protective transformer, welding torch, preheater for CO₂ and multipurpose welding rectifier. The machine is fitted with solenoid valve and water pressure switch to prevent any damage to the machine in case of inadequate air and water pressures respectively. The welding current and the wire speed are steplessly adjustable giving a possibility of maintaining a perfect balance between the feed rate and melting rate of the wire. The welding rectifier can be supplied with a remote control attachment also which will facilitate the operator in controlling the complete operation from one place.

For further details, contact: Kamubhai Engineers Private Limited, 3, Mangoe Lane, Calcutta-700 001.

Friction Welding

Jaya Hind Sciaky has introduced a friction welding machine. It works on the principle of heat generation by friction. One of the two components to be welded is rotated under very high speed rubbing against the other stationary component, thereby generating heat.

The machine automatically senses the heat generated and when the plastic zone of the material is reached, the rotation is suddenly stopped and the component is upset to form a weld. Jobs are loaded on to the spindle tail stock chucks. These chucks can be supplied with a hydraulic actuation to minimise operator fatigue and also save production time.

The machine is operated by pressing cycle start button. This causes the spindle to be engaged through a hydraulic clutch. The initial butting process is applied to generate heat by

friction, when the necessary amount of material is consumed, which is directly proportionate to the heat generated; limit switch actuation stops the spindle suddenly, and simultaneously forging pressure is applied on the weld.

This results in consistent weld quality ensuring that the heat generation is the same every time and also ensuring that all the molten material is squeezed out and the plastic zones are brought into contact. The advantage of this process is that the heat affected zone near the weld is very narrow. This fact has been brought out by certain research studies conducted on this subject.

It may be necessary to point out that the heat affected zone gives rise to fatigue failure after weld. This is an important aspect for tools manufacturers as safety is important.

Another aspect of the design of friction welding which may be worth mentioning is the hydraulic compensation provided to the spindle from the rear end by hydraulic pressure and it is done to minimise the axial loads, which will come up on the spindle bearing.

Friction welding power requirement is much lower and heat conditions that are developed in the material during welding can be accurately controlled and adjusted. Such machines are very popular in Europe and America for welding of automobile components cutting tools, etc.

Address: Jaya Hind Sciaky Ltd., DI Block, Plot No.18/1, Chinchwad, Pune-411 019.

Metal Testing Machine

Fine Spavy Associates MIDC Miraj, Maharashtra has introduced the Erichsen Tester which is designed to carry out tests on sheet metals of thickness in the range of 0.5 to 2 mm for assessing the cupping qualities of metal within the limits imposed by the test conditions. The machine can also be used for testing the adhesion, elasticity and porosity of coats of paints or varnish by way of comparison.

The surface appearance occurring on the surface of the specimen after fracture gives a guide to the grain constitution of the material. The configuration of the fracture provides an indication of the structure of the material.

The FSA's Erichsen testing machine is manufactured as per IS specification No. 1756-1974. This is claimed to be the only machine developed so far in India with preload arrangement of 1,000 kgs.

PACKAGING MACHINERY

Low Cost Labelling System

Volantis, an automatic self-adhesive label printing and applying system, is designed to top, side, wrap-around and bottom label any type of soft or hard product irrespective of shape or size, at speeds of upto 300/min depending on the type of label used. The system can be designed to suit customer's requirements.

Two basic models are available, the 100 and 150 which will handle labels up to 100 and 150 mm wide, respectively. Special features of the machine include disposable ink roller, detachable

print drum, solid state electronics and cantilever cover to facilitate easy label threading and machine setting. The machine is a self-contained unit with power pack and photo-electrics included, so no coupling leads are needed. It is fitted with a variable speed motor which enables the labelling operation to be matched to other functions on the line.

Optional extras include powered unwind and rewind units to facilitate easy operation when large or heavy reels are being used, an automatic label sensing device to stop the machine or conveyor should a label be missing on the label web and 100V conversion unit.

Details from: Norprint Ltd., Industrial Labelling Division, Boston, Lincolnshire, England.

Manually Operated Carton Sealer

The Uni 99 from DRG Holdfast Products is said to be ideal for sealing 'H' cartons and cases where no power supply is available. The Uni 99 is a manually operated two-length general purpose gummed tape dispenser, which will accept any tape up to 100 mm wide.

With each forward pull of the lever, moistened gummed paper tape is dispensed from the front of the machine and cut off when the lever is released. Both water level and brush pressure are fully adjustable and the moistening system is fed from a reservoir which is said to have the capacity for an average day's use without refilling.

The complete range of Holdfast gummed paper tapes including reinforced tapes can be dispensed from this machine in lengths from 200 mm to 1,050 mm.

Further details from: DRG Holdfast Products, Home Park, Kings Langley, Herts WD4 8LP, England.

Industry Roundup

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

GLASS INDUSTRY

Introduction:

Glass industry is a natural mineral based resource that serves as a country's base for sharpening its own indigenous technological expertise. The glass industry is by itself vital to the economic growth of the country requiring little foreign exchange and indeed, an excellent foreign exchange earner, the dire need of the day. Its wide application to both industrial and consumer products, gives it a dynamic scope in generating greater employment and purchasing power.

2. Present Status

The first glass factory with the technical assistance of an Austrian expert, set up, under Indian management was the Pioneer Glass Works at Titaghur in 1890 which was closed down after eight years due to the dearth of skilled technical personnel. The establishment of Paise Fund Glass Works at Talegaon near Poona in 1908 gave an impetus to the industry by serving as the centre for training of skilled workers. During world war I as many as 16 glass factories were established but only a few survived. The number of factories increased from 3 in 1914 to 14 in 1918.

After the war the imposition of duty enabled the industry to make some progress and there were 22 factories during the period 1923-32. The second Swadeshi Movement in the thirties also gave some impetus to the industry. About 90 glass factories were established and 60% self-sufficiency was attained. In order to provide trained scientific and technical personnel to the industry, the Department of Glass Technology was started at Banaras Hindu University in 1937.

In 1938-39, the number of factories producing glassware in India was 101. Expansion of the industry was particularly marked in U.P and West Bengal. Other centres of production were Poona, Broach and Panchmahals, Nagpur and Bhandra, Cuttack, Madras, Morvi, Hyderabad, Bangalore and Indore. The outbreak of World War II gave a fresh impetus to the industry and substantial expansion took place in hollowware manufacture. Some of the factories installed automatic machines for sheet glass and container-ware production. Improved types of furnaces were installed in some factories. New lines of production, such as, laboratory glassware, glass tubings and rods, glass beads and false pearls, thermos-flasks, ornamental glass plates, etc. were developed. The number of factories increased to 174 (including bangle factories) in 1945 and the production increased from 6 million sq.ft. of sheet glass and 43,000 tons of other glassware in 1938-39 to 13 million sq.ft. and 1,10,000 tons respectively.

The industry was not only able to meet a substantial part of the country's increasing requirements of glassware but also developed export trade with Ceylon, Malaya, Aden, Burma, Siam, Iran, Arabia, Kuwait, Singapore, Sudan, etc. as well as a few developed countries like USA, UK, Australia, Yugoslavia and Czechoslovakia. In 1952, 109 glass factories (including bangle

factories) were reported to have been in production in comparison to 187 and 509 (excluding bangle factories) in 1967 and 1969 respectively.

Distribution of glass factories in different states including small scale sector but excluding bangle factories during 1952, and 1969 is as follows:

Name of the State	Year		
	1958	1967	1969
Andhra Pradesh	2	7	10
Bihar	8	14	24
Delhi	2	5	9
Gujarat	1	5	14
Kerala	1	-	5
Madhya Pradesh	6	3	5
Maharashtra	22	20	66
Tamil Nadu	8	9	25
Karnataka	1	-	3
Orissa	1	-	5
Punjab	4	9	18
Rajasthan	2	2	3
Uttar Pradesh	21	63	141
West Bengal	30	50	181
Total	109	187	509

The First Plan started with an installed capacity of 2.13 lakh tones per annum. At the commencement of the Second Plan, there were 109 factories having an installed capacity of 2.90 lakh tonnes. In addition, there were 22 other factories with

capacity of 0.23 lakh tonnes lying closed. In 1961, the number of factories rose to 148 but only 97 factories with installed capacity of 3.83 lakh tonnes were in operation. The installed capacity at the end of the Third Plan increased to 6.15 lakh tonnes, representing about 100% increase but the production fell off to three lakh tonnes due to imbalance resulting from idle capacity in certain sectors.

The overall growth rate for the glass industry during the Third Plan was 12%. The rate decreased during the Fourth Plan on account of (i) production of tin plates at Rourkela Steel plant which boosted the production of tin containers (ii) competition from plastic containers and (iii) re-use of glass containers. The growth rate is computed at 10% during Fifth Plan which is much higher than the Fifth Plan strategy of overall growth rate for gross domestic product set at 5.5%.

The pattern of growth during the plan period in the organised sector is given below:

Year	Production in lakh tonnes	No.of units	Installed capacity	Overall annual rate	Average growth
1950-51	0.95		2.13		
1955-56	1.25		2.91	I plan	7.5%
1960-61	2.25		3.83	II plan	6%
1965-66	2.91		6.15	III plan	12%
1969-70	2.24	47	4.10		
1970-71	2.60	47	4.25	IV plan	3%
1971-72	2.90	48	4.30		
1972-73	3.00	4.63	-		

N.B: Figures from 1969-70 onwards have been reduced due to transfer of 77 units to the Small Scale Sector.

Sheet Glass Industry:

Sheet glass is a very important construction material required in all modern buildings. The sheet glass includes glass sheets, figured and wired glass and also covers subsequent processing of sheet glass, viz, toughened glass, laminated safety glass, mirror glass and insulite glass. The sheet glass industry being export oriented occupies a significant place in the economy of the country. About one-fifth of the total finished products of the industry are exported every year. The proportion of exports of sheet glass to total glass exports is about one-fourth.

After the independence, the developing trend of the industry is depicted with the help of table below:

Year	Manufacturing Units	Capacity in million Sq.mtrs	Capacity utilisation in percentage	Annual rate of growth in percentage
1950-51	3	6.10	15.10	27.0
1955-56	3	6.50(a)	58.0	16.7
1960-61	4	10.30	82.0	4.7
1965-66	6	20.13 * 2.56	40.4	12.5
1971-72	6	22.00	77.3	
1975-76	8	27.31 * 5.74	82.1	5.0

Note: (a) Estimated figure

* Manufacture of figured and wired glass

There are 8 industrial units engaged in the manufacture of sheet glass with an installed capacity of 27.31 million sq.mtrs. of sheet glass and 5.74 million sq.mtrs of figured and wired glass.

The individual unit's installed capacity is as follows:

Name of the Unit	Installed - capacity in mln.sq.mtrs.	
	Sheet glass	Figured and wired glass
1. M/s Hindustan Pilkington Glass Works Ltd, Asansol, West Bengal.	5.00	0.90
2. M/s Indo Asahi Glass Co.Ltd, Bhadani Nagar (Bihar).	4.60	
3. M/s Shree Vallabh Glass Works Ltd, Vallabh Vidhya Nagar (Gujarat).	4.80	3.50
4. M/s U.P. Glass Works Ltd, Bahjor, U.P.	1.67	
5. M/s Savaikella Glass Works Pvt., Ltd., Kandra, Bihar.	4.32	
6. M/s Madras Sheet Glass Works Pvt.Ltd., Tiruvottiyar, Tamil Nadu.	1.92	
7. M/s Window Glass Works Ltd, Calcutta, West Bengal.	-	1.34
8. M/s Triveni Sheet Glass Works Ltd, Allahabad, U.P.	5.00	
Total:	27.31	5.74

Besides, 5 more industrial units with an installed capacity of 28.70 million square metres to manufacture sheet glass as well

as figured and wired glass have also been set up recently. The total installed capacity in the country is only 61.75 million square metres. It is very low in comparison to the installed capacity of sheet glass manufacture in other countries like USA Europe, UK and USSR where the average annual installed capacity is about 300 million sq.metres. The installed capacity of sheet glass manufacture in the country is not enough to meet the requirements of the ever increasing demand. All the units are in private sector and no effort has so far been made in the public sector in this direction.

Production of Sheet Glass in India from 1969 is as follows:

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977
									estimated
Production (in term of 2 mm) lakh sq metres	142.8	146.5	165.4	165.4	165.0	152.0	143.6	208.5	240.0

The installed capacity and percentage utilization of capacity for sheet glass since 1962 are as follows:

Unit: Million Sq.Mtrs.								
Year	1961	1962	1963	1964	1965	1966	1967	1968
Installed capacity	14.5	14.5	18.37	18.37	18.37	18.37	20.2	20.2
% age Utiliza- tion of capacity	50	70	53	63	53	63	70	70
Year	1969	1970	1971	1972	1973	1974	1975	
Insta- lled capacity	20.2	20.2	20.2	22	22	27	28	
% age utiliza- tion	71	71	71	80	77	65	60	

India's import of sheet glass is restricted to thickness below 0.8 mm and above 6.5 mm. Imports of sheet glass during 1972-73 to 1975-76 are as follows:

Year	Quantity	Value Rs. in lakhs
1972-73	28,636	9.85
1973-74	3,576	2.21
1974-75	12,996	3.10
1975-76	16,077	4.66

India's exports of sheet glass during 1972-73 and 1975-76 are as follows:

(Square Metres)		
Year	Quantity	Value Rs. in lakhs
1972-73	1,218,091	76.85
1973-74	1,335,383	76.51
1974-75	1,725,175	82.78
1975-76	3,333,961	132.37

The production of wired and figured glass during 1975-77 is as follows:

Year	1975	1976	1977
Production in lakhs sq. metres.	35.3	38.0	47.0

Export of figured and wired glass during the last few years is as follows:

Year	1973-74	1974-75	1975-76
Value Rs. in lakhs	18.12	12.14	25.03

The demand for sheet glass was assessed by the Task Force at 300 lakh sq.mts per annum by 1978-79 and according to estimates made by DGTD recently, the demand of sheet glass may go up to 350 lakh sq.mts.

At present there is no unit manufacturing float glass/plate glass. Proposals for setting up of new units for the manufacture of float/flat glass will be considered on merits.

There is a shift from Fourcault process to PPG process which is producing better quality of sheet glass. Bulk of the new schemes have been approved for the manufacture of sheet glass by PPG process and colborn cleveral process.

Furnace oil, which is being imported at present is one of the inputs required for operating the furnaces. It is not essential to use oil firing process in sheet glass manufacture. Producer gas firing can replace oil firing. Some sheet glass factories are already operating on coal.

Safety glass is being manufactured from sheet glass and from imported plate glass in the organised sector by three firms. Mirrors of superior quality are also being manufactured by these three firms.

During 1977 production of items made out of sheet glass was of the order as under:

Laminated Glass	- - - -	1,55,000 sq.mts.
Toughened Glass	- - - -	3,26,000 sq.mts.
Mirrors	+ - - -	2,06,000 sq.mts.

Export of these items during 1975-76 were as under:

Laminated Glass & Toughened Glass	-	Rs.16.73 lakhs
Mirrors	-	Rs.13.23 lakhs

(To be Continued)

(KSDR)

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Current Technical Literature

Copies of articles/documents listed in this section are available on payment of Rs.5/- for the first 5 pages or part thereof and Re.1/- for every subsequent page of the photocopy or xerox copy of the article/document. While placing the order, please mention the CTL number of the SENDOC Bulletin.

<u>Subject Index</u>	<u>CTL Nos.</u>
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Technology Transfer

213. GHARDURE YH: Development of technology in laboratory and technology transfer. Chemical Industry News, 1979, 24(8), 537-550.

Highlights the aspects of process development in R&D laboratory and through international collaboration. Enumerates the problems involved in exploitation of indigenous technology. Discusses transfer of technology, mode of technology transfer, assimilation and improvement of imported technology, transfer of technology from developed to developing countries and among developing countries. Gives the expenditure for R&D by various countries during 1970-71.(BS)

214. GAITONDE VA: What is transfer of technology. Chemical weekly, 1979, 24(19), 74-76, 78, 79.

The significant components of technological transfer are the acquisitions of know how, mastering of advanced methods, of organisation and management, formation of a hard core of national skilled workers, technicians, engineers, designers, scientists, administrators and managers. Discusses the real dangers that arise from the transfer of technology to developing nations and the type of technology required by developing countries.(MSR)

215. ROHATGI PK et al: Technology assessment for India. Journal of Scientific and Industrial Research, 1979, 38(11), 603-610.

The need for technology assessment (TA) in India is established and a formal organizational structure for doing

this work is outlined. The methodology for doing this is assessed. Some indications are made of the cost and time needed for TA. Recommendations are made so that the process of TA in India can get to a healthy take-off point.

216. SIDHU GS: Some suggestions for an integrated approach to indigenous development, import and absorption of technology. Chemical Weekly, 1979, 24(20), 69, 70, 72, 74.

Discusses the drawbacks in the import of technology and its absorption. Suggests some measures to achieve self-reliance in technology and emphasises on adoption of integrated technology.(MSR)

RESOURCES

Waste Utilisation

217. DURGAPAL BC et al: Valuable products from some agricultural wastes. Petroleum & Chemical Industry Developments, 1979, 13(7), 13-15.

Deals with the utilization of by-products such as bagasse, molasses, filter-cake, arhar sticks and cotton linters which are at present being under-utilised in our country.(BS)

218. PANDEY SK: Efficient use of agricultural wastes and by-products, agriculture and Agro Industries Journal, 1978, 11(2), 21-23.

Highlights the availability and commercial exploitation and potential uses of agricultural wastes and by-products. (MKSS)

219. PANDEY SN & MEHTA AK: Industrial Utilisation of agricultural waste products: Cotton plant stalk. Research and Industry, 1979, 24(2), 75-79.

The various possible industrial applications of cotton plant stalk, and agricultural wastes are discussed. The stalk contains about 46% cellulose and 26% lignin. Besides use as fuel, it can be utilised for the production of boards, fillers, pulp and paper, regenerated cellulose and cellulose derivatives (esters and ethers), microcrystalline cellulose, furfural, lignin and animal feeds. Some of these industries can be set up in rural areas, where the raw material is available in abundance. This will help provide additional employment opportunities to rural masses.(AA)

220. SAMADANI S G et al: Use of industrial agricultural wastes for making glasses. Indian Ceramics, 1978, 21(9), 249-250.

Presents an investigation in which efforts were made to develop glass batches exclusively from industrial and agricultural wastes. Gives the composition and properties of different wastes.(BS)

FOOD AND ALLIED INDUSTRIES

Fish and Other Seafoods

221. -----: Fish processing and canning industry-A profile. Industrial Researcher, 1979, 6(2), 113-116.

Reviews the present status of the industry in India and indicates that for a 1 tonne per annum capacity plant, an investment of Rs.7 to 10 lakhs will be required. Emphasises the need for establishing modern processing and packaging units and development of ancillary industries.(JBS)

222. -----: India's export potentiality for marine products. Industrial Researcher, 1979, 6(3), 187-189.
223. CHANDRASEKHAR TC: A method of processing and preservation of brawn pickle. Seafood Export Journal, 1979, 11(1), 15-18.
Main raw and submaterials, their preparation and the recipe for brawn pickle preparation are given.(MKSS)
224. DEVADASAN K & VENKATARAMAN R: On fish meal and our fish meal industry. Seafood Export Journal, 1979, 11(1), 9-13.
Highlights the importance of fish meal over oilseeds cake meal proteins, essential aminoacids, minerals, etc. Discusses the present status and practices adopted in the country including the problems of the fish meal industry. (MKSS)
225. SARALAYA KV: Fish processing and diversification. Seafood Export Journal, 1979, 11(3), 9-14.
Detailed discussion on processing steps and preservation methods including a diversification programme in fish processing is presented. List of I.S.I. specifications for fish and fish products is also given.(MKSS)
226. THOMAS F & MATHEN C: Water in seafood processing. Seafood Export Journal, 1979, 11(4), 15-17, 19-21, 23-26, 28-29, 31-34.
The quality requirements of process water in seafood processing are discussed with emphasis on their physical, chemical, bacteriological and biological characteristics. (AA)

CHEMICAL INDUSTRIES

227. -----: The progress of India's alkali industry during 1978. Colour & Chemical Weekly, 1979, 5(20), 37-43.

Gives the statistics of raw materials production from 1970 to 1978, trends in cost of main raw materials, caustic soda capacity as on 1st Jan 1979 and production during the past three years, soda ash capacity as on 1st Jan 1979 and production during past three years and additional capacities sanctioned for caustic soda as on 1st April, 1979. (BS)

228. -----: Tooth paste. The Chemical & Polymer Times, 1979, 7(2), 6.

Gives a profile on the manufacture of toothpaste. Estimates the fixed capital investment at Rs.1,80,000 for a plant of 240 kgs. per day capacity.

229. -----: Toothpaste - An industry review. Industrial Researcher, 1979, 6(2), 77-81.

At present, the toothpaste industry has 11 units in the organised sector with a combined installed capacity of 4200 tonnes. The toothpastes available in the market could be divided into those meant for daily use and those meant for specific applications. In the case of the former, there is heavy brand competition. The article analyses the demand for toothpaste and indicates that good scope exists for meeting the demand for toothpaste through new units in the small scale sector.

230. KHARBANDA OP: Calcium carbonate. Chemical Weekly, 1979, 24(26), 76-79.

Typical process and requirements for the manufacture of calcium carbonate are given. Producers with their capacities and demand of calcium carbonate and technoeconomic details are briefly given.(MSR)

231. SONI D.G: Benzene-based chemicals. Chemical Weekly, 1979, 24(24), 143-146, 148.

Industrial manufacturing process of chlorinated aniline is described. Physical and chemical properties of acetanilide and manufacturing process and raw materials, equipment and capital requirements for the manufacture of acetanilide are described in detail.(MSR)

232. SONI DG: Benzene based chemicals. Chemical Weekly, 1979, 24(25), 149, 151-154 and 156.

Infrastructure, raw materials and equipment required for the manufacture of nitro-chlorobenzene are given in detail. Physical properties, methods of separation of ortho, meta and para nitrochlorobenzene and scope are discussed. Flow chart for the manufacture of the product is given. The economic size of the plant for a small scale unit is 1 tonne/day and for organised sector 5 TPD on single shift basis.(MSR)

233. SONI DG: Benzene-based chemicals. Chemical Weekly, 1979, 24(26), 157-162.

Discusses the instrumentation, pollution controls, costs and labour for the manufacture of nitrochlorobenzene. Describes briefly the manufacture of nitrophenetols along with a flow chart (MSR)

PLASTICS

234. -----: Alkyd resins - A feasibility study. Industrial Researcher, 1979, 6(3), 161-172.

The cost of a 300 tonnes per annum project is assessed at Rs.15 lakhs and the total turnover at Rs.46 lakhs. The project offers good profitability with a ratio of operating profit to sales around 14 to 15 per cent.(JBS)

235. -----: PVC/PILC and cross linked polyethylene power cables: A demand analysis. Industrial Researcher, 1979, 6(1), 43-47.

The study attempts to assess the future demand for power cables in India by linking apparent consumption of these cables with addition to the installed power generation capacity.(JBS)

236. -----: PVC hosepipes - a feasibility study. Industrial Researcher, 1979, 6(1), 35-40.

The study envisages the establishment of a minimum economic size plant with a single screw extruder, having 40 kg/hour capacity, at a cost of Rs.5.50 lakhs. The operating profit to sales ratio works out at 12.5%, operating profit to total capital employed ratio is 31.7% and net profit to equity capital ratio at 71.4%.(JBS)

237. GARSHMAN: Injection moulding - the next five years. Plastic Technology, 1979, 25(1), 27-29, 30 & 32.

This report pinpoints the key trends envisioned for injection moulding in the years ahead.(KSDR)

LEATHER INDUSTRY

238. -----: Leather and footwear machinery: Good prospects for investment. Industrial Researcher, 1979, 6(1), 55-60.

It is estimated that by 1982-83, the demand for leather and footwear machinery would be around Rs.60 million and there will be a large demand supply gap. An attempt is made to analyse the present status and future growth of this industry.(JBS)

239. -----: Statistical profile on leather hides, leather belts and leather footwear industry. Industrial Researcher, 1979, 6(2), 149-152.

240. BIHUNJ: Synthetic fatliquors. The Leather Manufacturer, 1979, 97(6), 22-26.

Describes various synthetic fat liquors which are substitutes to the existing ones.(BS)

241. SCHROEDER S: The production and manufacture of leather oils and fat liquors. The Leather Manufacturer, 1979, 97(6), 16-21

Discusses the developments in production process of four types of leather oil products - anionics, cationics, non-ionics and raw oils.(BS)

242. TANCOUS J: Quick tests for quality control. Leather, 1979, 181(4449), 45-46.

Gives a package of quick tests which enable tanners to check for common defects quickly and avoid the delays involved in sending out samples to laboratories.(BS)

243. TANCOS JJ: Quick tests for 'trouble shooting' in the tannery
'Journal of the Indian Leather Technologists' Association, 1979
27(3), 14-18.

Gives the compilation of 29 simple tests to enable tanners to have kits made up and check common defects at the time of occurrence.(BS)

MINERAL BASED INDUSTRIES

244. -----: Development of special glasses and ceramics of BEL.
Electronics - Information and Planning, 1979, 6(8), 753-756.

Outlines the plans and programmes of research and development activities in the area of special glasses and ceramics by Bharat Electronics Limited, Bangalore.

245. -----: Economy and industry: Mini-cement projects-A controversial issue. Industrial Researcher, 1979, 6(2), 75-76.

Evaluates available processes and technology, their cost and profitability, the location of the project and the equity for financing it.

246. -----: Growth prospects for the cement machinery industry. Industrial Researcher, 1979, 5(4), 209-212.

247. -----: Limestone base for cement industry in India. Chemical Age of India, 1978, 29(7), 529-534.

Discusses the requirements and the reserves of limestone. Gives the statewise limestone deposits with installed cement manufacturing capacity and the capacities approved by the Government of India. A list of schemes approved in public and private sectors in the north eastern region, is also given.(BS)

248. -----: Materials for ceramics. Ceramic Industry, 1979, (January), 41-119.

Enumerates the properties and applications of various ceramic materials.(BS)

249. CHOPRA SK & NARANG KG: Industrial wastes in cement manufacture-status and prospects. Chemical Age of India, 1978, 29(7), 543-552.

Gives the present and future prospects of cement production (estimates), presents the need for evaluating the intrinsic potentials of the major industrial wastes and reviews the status and prospects of their large scale utilisation in cement industry. Suggests measures which will increase the availability of cement and its raw materials.(BS)

250. KALE H V: Choice of a kiln for "mini cement plant" Indian Ceramics, 1978, 21(2), 33-36.

Reviews the present state of the cement production in India and examines the suitability of ceramic kiln, normally used for processing refractory bricks at 1350-1400°C for producing cement in mini plants.(BS)

251. PASTALA A L: Economics of mini cement plant. Indian Ceramics, 1978, 20(10), 339-342.

Examines the economic aspects of mini cement plants in comparison with large capacity plants.(BS)

252. RAO SB et al: Indian chrome ores for chromium chemicals. Vishwakarma, 1979, 19(9), 1-7.

Gives the statistical data on world production of chromite during 1970-73, statewise production of chromite in India,

the statewide reserves of metallurgical and non-metallurgical chromite ore, consumptions of chromite in various industries, capacities, specifications and sources of supply of chromite for chemical use. Discusses the utilisation of chrome ores in the production of chromium based chemicals.(KSDR)

- 253, SUBRAHMANYAM N: Cement industry in India - Current status and future prospects. Chemical Age of India, 1978, 29(7), 505-512.

Current status of the cement industry in India is reviewed. Position of raw materials and current technological trends in the cement industry to meet the future demand for cement in the country are discussed.(AA)

- 254, VISVESVARAYA H C: Mini cement plants. Chemical Age of India, 1978, 29(7), 553-560.

Highlights the need for mini cement plants, availability of know-how and discusses the process details and economics of small rotary kiln plant and vertical shaft kilns.(BS)

MECHANICAL ENGINEERING

255. -----: Automobile ancillary industry. Bombay Market, 1979, 43(3), 91-96.

Gives the review and future prospects of automobile ancillary industry with some statistical data.(KLR)

256. -----: Automobile industry; a review and future prospects. Bombay Market, 1979, 43(2), 101-104.

257. -----: Bending has the edge on blanking. Machinery and Production Engineering, 1979, 135(3471), 25-27.

Describes new process of bending a flat strip into a washer-shaped item, a promising technique which virtually eliminates scrap.(KLR)

258. -----: The bicycle industry - Scope for small units. Industrial Researcher, 1979, 6(2), 131-138.

259. -----: Bicycle tyres - A study on its growth potential. Industrial Researcher, 1979, 6(3), 191-196.

Makes an assessment of the future domestic and export demand for the bicycle tyre industry. The existing capacity in the small scale sector is about 52 million number/year and scope for a capacity of 13 million number/year by 1982-83 is pointed out.(JBS)

260. -----: Conveyor and V belts - An examination of export potentiality. Industrial Researcher, 1979, 6(3), 211-223.

Deals with the export of conveyor belts, fan belts and v belts, and attempts to analyse the past and present trends of India's export to various regions. Examines India's competitiveness with other countries and identifies further the different export potential areas for India.(JBS)

261. -----: Mechanical details of fuel injection equipment. Earth Moving Guide, 1979, 14(170), 31-36.

Design and function of each component of fuel injection pump are given. Timings of the injection pump to the engine lubrication, maintenance to be observed are also given. (LKPC)

262. -----: Portable power tools. Industrial Maintenance and Plant Operation, 1979, 40(1), 120-121.

Outlines the principles of power tools and their types. Discusses the functions of various types of power tools, namely, abrasive tools, cutting tools, drills and hammers, fastening tools, etc.(SS)

263. WOODLEY B J: Materials for gears. Tribology International, 1979, 10(6), 323-332.

This article confines itself mainly to tribological considerations and hence can be used for the initial choice of gear materials. It discusses the properties required for gear materials, gives data on these properties for commonly used gear materials, and gives examples of gear material combinations which have performed satisfactorily in service.

ELECTRICAL INDUSTRIES

264. -----: Demand for transformers - Opportunities for small scale sector. Industrial Researcher, 1979, 6(1), 49-53.

The installed capacity the organised sector is of the order of 22.2 million kva as against the output in 1977-78 at 18.0 million kva. A large number of small scale units are also producing distribution transformers. In order to assess the future demand, the trend method and linear equation methods are employed. The scope for new units in the small scale sector appears promising.(JBS)

265. -----: Electric motor manufacturers: IEMA members. Electrical India, 1979, 19(16), 70A-L.

266. RAJESH B: Single winding two speed pam motors. Electrical India, 1979, 19(22), 17-19.

Two-speed motors using PAM technique, along with their applications are discussed.(LKPC)

267. VALIA A.T: Planned maintenance of lighting installations. Indian Electrical Contractor and Trader, 1980, 30(1), 14-19.

Enumerates the need for maintenance of electrical installations, along with causes of different types of depreciation factors, maintenance procedures and maintenance techniques. (LKPC)

ELECTRONICS INDUSTRIES

268. CHANDRASEKHAR P et al: Microprogramming and computers - An analysis. Electronics - Information and Planning, 1979, 6(11) 861-879.

With recent advances in large scale integration (LSI) technology and in other related areas, the cost of computer hardware is coming down fast. In fact, over the next 10 years the cost of computer hardware is predicted to decrease by a factor of ten or so. The cost of software on the other hand is increasing steadily because of escalation in manpower cost. To cope with this, the industry is turning to software development through use of hardware tools such as microprogrammable RAM, ROM etc. These constitute the area of 'firmware'. The benefits that this development has given to the growth of the computer industry are analysed in this report. Efforts need to be launched in India to enter this field are also briefly outlined.

269. CHOPRA R.C: An analysis of the economic impact of the TV industry. Electronics - Information and Planning, 1979, 6(11), 880-987.

In this report the performance of TV industry has been analysed. Estimates have been made regarding the investments already made in establishing the existing infrastructure, employment generated and revenue from the industry.

270. JAIN L.C: Introduction to computers. Indian Electrical Contractor and Trader, 1980, 30(1), 9-11.

The functions of a computer are mentioned. Classification of computers is also given. Computation history is highlighted.(CS)

271. YAMAMOTO K: Coreless motors meet stringent operational requirements. Journal of Electronic Engineering, 1979, 16(151), 39-41.

Briefly explains various micromotors and coreless motors with photos and diagrams.(VVR)

-oOo-

SENDOC Services

Featured in this section are technical enquiries that were received and the services rendered by SENDOC during the month of April 1980. The charges for short technical enquiries will be Rs.5.00 to Rs.10.00 per typed page. Industry profiles already available with SENDOC are charged at the rate of Rs.10.00 each.

S.No.	Enquirer	Service Rendered
1.	DIC, Hyderabad, Andhra Pradesh	Profile on: Reclaiming of rubber
2.	Ent.Andhra Pradesh	Profiles on: Zinc sulphate, Lubricating oil, Ferric alum, Balloons, Coke briquetting, Electroplating, Ether.
3.	Ent. - Bihar	Profiles on: Rope making, Bicycle rim, Mini paper mill.
4.	Ent. - Karnataka	Profiles on: Tyre retreading, Lenses, Wooden packing cases, Ammonia paper, Zinc Oxide, Coconut powder.
5.	Ent. - Maharashtra	Profile on: Agarbathies.
6.	Ent. - Tamil Nadu	Profile on: Stainless steel utensils, Oxalic acid.
7.	Ent. - Uttar Pradesh	Profile on: Straw board.
8.	Ent. - West Africa	Profile on: Pectin from raw papaya.

S.No	Enquirer	Service Rendered
9. FI - Somalia, Africa		Profiles on: Absorbent cotton, Agricultural implements, Aluminium alloy extruded parts, Bakelite moulded goods, Bakery products, Bolts and nuts, Rivets, Bone crushing, Glass bottles, Box strapping, GI bucket, Candles, Coir, Crown cork, Corn flakes, Cosmetics, Crockery, Cutlery, Aluminium, Distilled water injectable, Electric iron, Electrical accessories, Electrical appliances (domestic), Exercise books, File covers, Electric fan, Fertiliser, Paper clips and pins, Glassware, Hand tools, HDPE containers, HDPE monofilament yarn, GLS lamp, HDPE collapsible tubes, Leather, chrome tanning Lime - hydrated, Machine screws, Naphthalene ball, Fishery net, PVC pipes, Stoneware pipe, Plastic cane, Plastic container, Plastic moulded goods, Prestressed cement concrete poles, Polyethylene tubes, Quicklime, Rice bran oil, Rubber moulded goods, Stoneware pipes and fittings, Electric stove, Straw board from bagasse, Table salt, Roof tiles (Mangalore), PVC tile, Wood screws.
10. GD - Maharashtra		Profiles on: Absolute alcohol from molasses, Cardboard from bagasse, Cottonseed oil, Solvent extraction, Enzyme industry.
11. GD - New Delhi		Profile on: Bakery products.
12. GD - Tamil Nadu		Profile on: Mini rice mill.
13. GD - Uttar Pradesh		Bibliography on: Appropriate Technology.

S.No.	Enquirer	Service Rendered
14. SI - Assam		Profile on: Gelatin capsules.
15. SI - Chandigarh		Profile on: Car polish.
16. SI - Karnataka		Profile on: Rivets, Food preservation.
17. SI - Kerala		Profiles on: Fish oil, Fish meal.
18. SI - Maharashtra		Profiles on: Cement bricks, Straw board, Armature rewinding, Starch from tamarind seed, Handmade paper, Bricks, Corn flakes, Sulphuric acid, Stainless steel utensils, Paper bags, Polythelene bags.
19. SI - Orissa		Profile on: Ferric alum.
20. SI - Rajasthan		Profile on: Starch plant.
21. SI - Uttar Pradesh		Profiles on: Welding electrodes, Cotton seed oil, Sulphuric acid.

Note: DIC - District Industries Centre, Ent. - Entrepreneur,
 FI - Financial Institutions, GD - Government Department,
 SI - Small Industry.

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13 JUN 1961

Section I

New Products and Processes

CHEMICAL INDUSTRIES

Kettle for Calcination

The open pan process generally employed in India for the manufacture of plaster of paris or gypsum plaster does not permit close temperature control for the calcination of gypsum. As a result the quality and performance of the plaster are not consistent and vary within wide limits. Further, the fuel consumption and dust losses during calcination are high and the production is comparatively low.

The properties of the plaster are influenced not only by the quality of gypsum used but also by control over the temperature of calcination, its uniform distribution and the duration of calcination. Need had been felt for developing an equipment with efficient system of simultaneous agitation and calcination of raw gypsum powder to get uniform quality plasters suitable for making pottery moulds, plaster boards, blocks, tiles, decorative moulding etc. on commercial scale.

A kettle, amenable to much better controls and having high thermal efficiency, was designed at Central Building Research Institute, Roorkee.

The kettle developed has a capacity of 1 tonne per charge. The time involved in calcining the first charge of gypsum is about 5 hours whereas subsequent charges take 4 hours, since

the kettle is already heated up. The kettle is a steel shell provided with mechanical stirring arrangement to ensure thorough agitation of the material during calcination. Heating is done both directly and indirectly to ensure uniform heating of the charge in the kettle.

A kettle of one tonne capacity has been designed, fabricated and installed at the Institute. It has been operated successfully for calcining ground gypsum under controlled conditions.

Cast iron bottom, kettle shell, shaft with blades and accessories, 10 H P motor, top cover plate, flue pipes and chimney, scaffolding, receiving hopper are the parts required. All these parts are available indigenously or can be fabricated.

The parts required for the kettle can be got fabricated from local units and as such there is no need for a full-fledged facility for the same. Some hand tools will, however, be required for assembly of parts.

An entrepreneur interested in production of plaster of paris would need an investment of Rs.0.1 million for a plant producing 240 metric tonnes per annum on one shift per day basis. The kettle is estimated to cost Rs.20,000. The facility can employ three persons.

Lime Hydrator

Hydrated lime is used in the manufacture of sand lime bricks and insulation materials, in road construction for soil stabilisation of road bases, in the manufacture of refractories and in ore dressing. It is used in chemical process industries such as alkali, calcium carbide, glass, sugar, insecticides,

bleaching powder, petroleum, rubber, and paint industries. It is also used in water treatment.

Conventional methods of lime hydration by adding all the water at a time, has certain disadvantages. The final product thus obtained is not of the desired quality and is not completely dry to be suitable for packing in bags.

The process of hydration of lime has been very much simplified by the design of a lime hydrator by Central Building Research Institute, Roorkee. The hydrator utilises the heat produced during the process of hydration, achieves thorough mixing and gives almost dry product which can be easily packed. The lime produced is in the concentrated form, because the core and other impurities are eliminated during the process.

The hydrator is a small unit and occupies only about 3 metre x 1.5 metre space. The hydrator consists essentially of three tiers, the first tier of which acts as a premixer. The design has been kept flexible such that the rate of movement of the material and consequently the contact period available for the reaction between lime and water can be altered. This permits the hydration of reactive and also not-so-reactive limes. In the second tier, the steam generated during the process of hydration is not allowed to escape to the atmosphere, but is utilised in pre-heating the water that effects hydration. As a result of mixing hot water with lime, the reaction takes place at an enhanced rate and the hydration is effected sooner. In the third tier, the reaction gets completed, the water gets mostly utilised and the excess water escapes as steam. The lime is, therefore, in an almost dry state when it is discharged.

A prototype machine (7 tonnes per day) has been developed. This has been working satisfactorily for several months.

The manufacture of the hydrator does not need sophisticated equipment. Simple workshop facilities would be necessary for fabrication of some parts and assembly. Some of the parts may have to be got fabricated from local manufacturers. Higher capacity plants would need a crusher for crushing quick lime to the desired size.

The materials required for fabrication of the hydrator are ordinary metal sheets, electric motor and other items such as rods, nuts, bolts. All these are indigenously available.

The unit would need ordinary workshop facilities for assembly and maintenance of the hydrator. The hydrator of the above capacity would cost about Rs.0.15 million. The hydrator has a potential to employ about twelve persons.

Potassium Schoenite

Potassium schoenite ($K_2SO_4 \cdot MgSO_4 \cdot 6H_2O$) is a double sulphate of potassium and magnesium. It contains 22-24% K_2O and 9-11% MgO . It can be prepared from mixed salt, obtained by evaporation of sea bitterns.

Potassium schoenite has been used as a potassic fertilizer in Western countries. It can replace potassium sulphate, entirely imported at present. Besides, the magnesium present in potassium schoenite is a secondary essential plant nutrient and helps in assimilation of other nutrients available in the fertiliser.

Potassium schoenite is specially suitable for crops that do not tolerate chlorine viz. tobacco, potato, sugarcane etc. It is also preferred for crops such as citrus fruits, grapes, tea, coffee, rubber, arecanut.

Mixed salt is ground in a hammer mill. The material passing through 45 mesh screen is mixed with the schoenite end liquor to maintain a ratio of 1:4:5 (wt/vol) of undissolved solids to pulp. As the presence of sodium chloride hinders the formation of schoenite, it is necessary to remove the same by flotation. For this purpose the pulp is conditioned by adding octadecylamine acetate and highly sulphonated castor oil as floating agents. On flotation, kainite ($\text{KCl} \cdot \text{Mg SO}_4 \cdot 3\text{H}_2\text{O}$) separates out and sodium chloride remaining in the tailings is discarded.

The floated material containing kainite is centrifuged and treated with water at controlled temperature. The schoenite formed by double decomposition is separated in a centrifuge and dried in the open. Schoenite end liquor obtained is sent to storage for re-use.

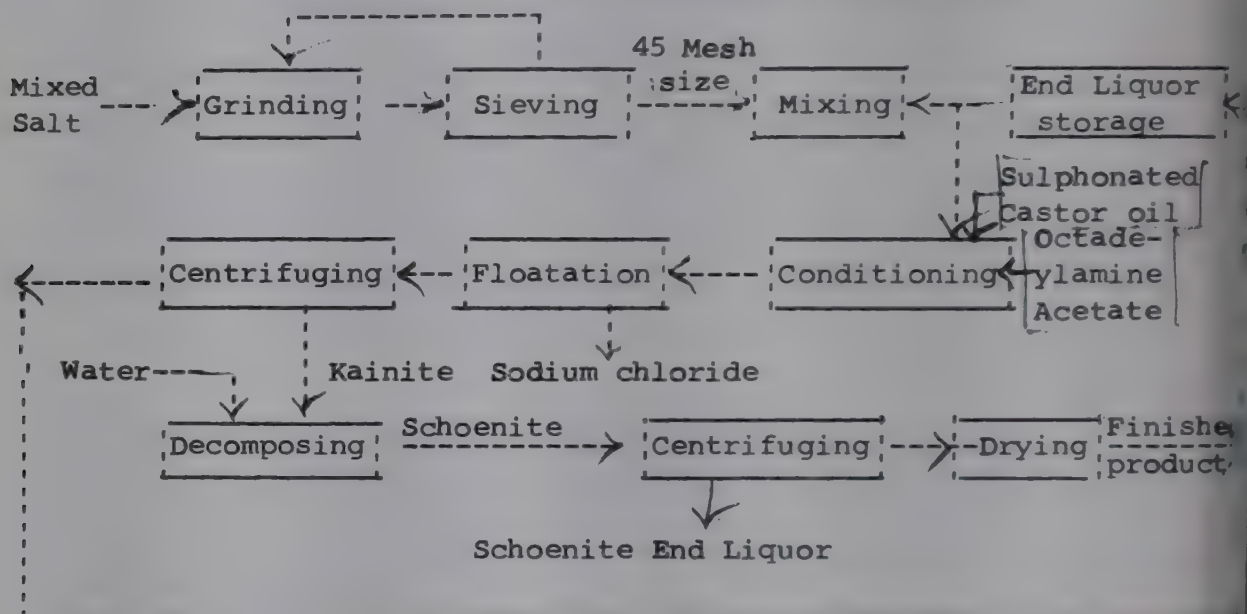
The process has been studied on a pilot plant having a capacity of 1.5 tonnes of schoenite per day at the Central Salt and Marine Chemicals Research Institute, Bhavnagar.

The raw materials required in the process are mixed salt from sea bitterns, octadecylamine acetate, sulphonated castor oil. All these are available in the country.

The main items of equipment include floatation cell, centrifuge, decomposer, conditioner, mixer, crusher, bucket elevators. All these are indigenously available.

It is estimated that a plant having a capacity of 10 tonnes/day will need an investment of Rs.0.5 million, excluding land and buildings. The plant has a potential for employing 40 persons including direct labour.

BLOCK FLOW DIAGRAM FOR POTASSIUM SCHOENITE



Sodium Azide

Sodium azide is a strategic raw material. Bulk of the detonators, both for military and civilian use are made from this material. It is used in the preparation of lead and silver azides, which are used in the manufacture of detonators. Indian Detonators Ltd., Hyderabad, Indian Explosives Ltd., Gomia, High Explosives Factory, Kirkee and Ordnance Factory, Jabalpur are the main consumers of this product. The estimated annual domestic demand is about 12 tonnes.

Sodium azide is prepared by reacting ethyl nitrite with hydrazine hydrate in sodium hydroxide solution. The crude azide is purified, dried and packed.

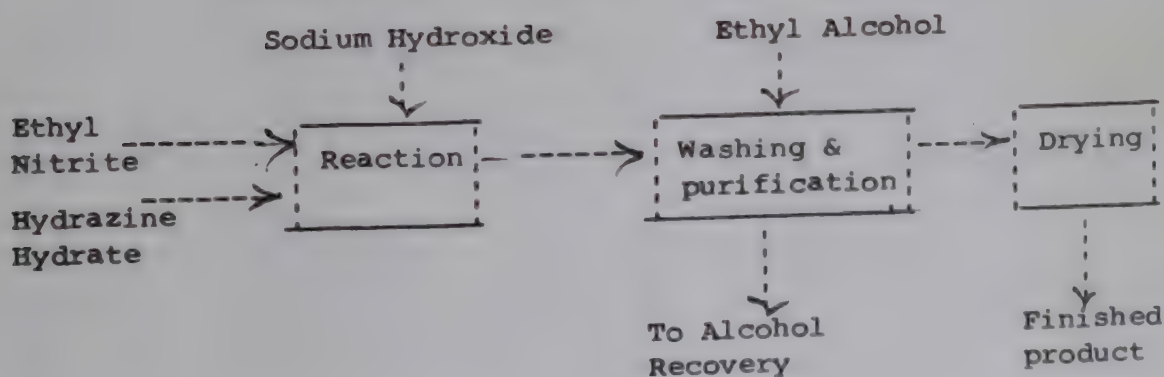
A total quantity of 5 tonnes of this chemical was prepared in the Regional Research Laboratory, Hyderabad for defence requirements and was found to be satisfactory.

The main raw materials required in the manufacture of sodium azide are hydrazine hydrate, sodium hydroxide, ethyl alcohol sulphuric acid, sodium nitrite and nitrogen. All the raw materials are indigenously available.

The main equipment are reaction vessels, drier, pumps and other materials handling equipment. All these are available indigenously.

The investment on plant and machinery required for a unit having a capacity of 60 tonnes per annum is estimated at Rs.1.0 million. For operating the plant about 10 persons are required.

BLOCK FLOW DIAGRAM FOR SODIUM AZIDE



ELECTRONICS AND ELECTRICAL INDUSTRIES

Community Antenna TV System

The cable TV or community antenna is known as CATV system. Normally an individual antenna is used for feeding signal to a TV receiver, but the problem arises when it is not possible to use independent antenna for each receiver. For example, the residents of a multistorey building cannot have separate antennas. Another limitation is due to the restrictions posed by Corporations of urban cities. A cluster of antennas may provide an ugly look and in addition, there is a possibility of interaction between these antennas. Television reception in multistorey buildings in metropolitan cities poses problems due to long cabling, improper location of antennas causing ghosts and other interferences in reception. The CATV system helps to overcome these problems, and provides uniform quality signal for each receiver at any point in a multistoreyed building.

The system as developed at the Central Electronics Engineering Research Institute (CEERI), Pilani consists of the following parts.

- | | |
|---------------------------|-------------------|
| 1. A master antenna | 4. Isolation pads |
| 2. Distribution amplifier | 5. Power supply |
| 3. Splitter | 6. Baluns |

The master antenna picks up the signal and feeds to the distribution amplifier. The amplifier provides sufficient amplification for further distribution through various outputs. Each output of the distribution amplifier is connected to a splitter which may be either passive or active. Each output of the splitter serves a number of TV sets on the common floor through

the isolation pads. Baluns are used to convert balance to unbalance inputs or vice-versa.

The system for operation on channel 4 (61-68MHz) has been designed and developed with the following specifications at the institute. Reasonable number of amplifiers, antennas, splitters, pads and power supply, have been batch produced. Demonstrations have been given in Delhi and Bombay. The performance has been found satisfactory.

A Six Element Yagi Antenna

Frequency band	61 to 68 MHz
Gain	9 db
Front to back ratio	17 db
Input impedance	300 ohms (balanced)
VSWR	Less than 2

B. Booster Amplifier

Frequency response	± 0.5 db within the channel
Gain	20 ± 2 db
Input impedance	300 ohms (balanced)
Output impedance	75 ohms (unbalanced)

C. RF Distribution Amplifier

Input impedance	300 ohms (balanced)
Output impedance	75 ohms (unbalanced)
Frequency response	± 5 db (flat within ± 0.5 db)
Gain	45 ± 2 db
No. of outputs	5

D. Isolation Pads

Minimum isolation	14 db
Maximum isolation	32 db
Input impedance	75 ohms (unbalanced)
Output impedance	300 ohms (balanced)

The materials required are transistors, diodes, resistors, capacitors, inductors, connectors, aluminium sheet, tubes, connectors, coaxial cables. All these are available indigenously.

The major equipment involved in the production are workshop facilities, assembly and testing facilities such as oscilloscope, crystal detector, and VHF impedance bridge, VHF sweep generator, multimeter, transistor tester, VTVM. Out of these some items may have to be imported.

The total capital investment for manufacturing 2000 systems per annum on single shift per day basis, has been estimated at Rs.0.7 million, excluding land and buildings. The plant has a potential to employ about seventeen persons.

Digital Multimeter

Digital multimeter is an instrument used for precise and accurate measurement of resistances, direct and alternating currents and voltages. It holds display between samples through the use of memory latches. It finds wide use in R&D organisations, educational institutions, production and quality control centres and industries.

The design of the digital multimeter is based on the dual slope integrator concept. Integrated devices are used to make it accurate, reliable, compact and light in weight.

An FET input operational amplifier is used to obtain very high input impedance. The unipolarity amplifier provides the positive output irrespective of polarity of the input voltage.

The buffer amplifier provides a gain of 10 or unity. AC voltage is measured after converting it into DC by a high precision rectification circuit using operational amplifier. Resistance is measured by first converting the input amplifier into a precision constant-current source. The current is then passed through the unknown resistance and the voltage across the resistance is measured by the voltmeter. The A/D convertor consists of switches, an integrator, comparator and highly stabilised voltage reference. Integrator uses an operational amplifier and capacitor in the feed back. Control and display circuit consists of reset, transfer, polarity control, 33 KHz clock, decade counter, binary latches, decoder, drivers and nixie tubes. The reset and transfer circuit are basically monostable circuits.

The output of the counter is inherently encoded in BCD which is then decoded and displayed.

The Central Scientific Instruments Organisation (CSIO), Chandigarh has fabricated three pieces of the following specifications. Their performance has been found satisfactory.

Voltage	AC & DC 100 mV to 100 V fs.
resolution	100 micro volts
Resistance	1 K ohm to 10 m ohm fs.
resolution	1 ohm
Current	1 to 1000 mA fs.
resolution	1 micro amp
Input Impedance	DC More than 1000 ohm on basic range AC 1 M ohm shunted by 20 pf

AC response	10 Hz to 20 KHz
Accuracy	DC $\pm$ 0.1% $\pm$ 1 digit AC $\pm$ 0.2% $\pm$ 1 digit
Display	4 digit nixie automatic decimal & polarity indication
Over range	100%

The main materials and components needed are integrated circuits, nixie tubes, transistors, resistance. All these are available indigenously.

The main testing equipment needed are LCR bridge, oscilloscope, variac, power supplies, mains voltage stabilizer, multimeter, CRO, precision digital multimeter, pulse generator. All these, except the precision multimeter, are available indigenously.

A unit to manufacture 100 pieces per annum is estimated to need an investment of Rs.0.2 million, excluding land and buildings. A manufacturing unit of the above size is expected to employ fifteen persons.

Microwave Intruder Detector

The microwave intruder detector is capable of detecting human intrusion in strong rooms, vaults and unattended security areas by giving an aural alarm. This unit is quite simple in operation and covers a big area for detection. It requires very little attention from the operator, who will be mostly free to attend to other duties until alerted by the alarm caused by intrusion. The device can function both during day and night. So far such devices have not been introduced in the country. However, in view of the successful utilisation of similar devices

in the advanced countries, it is expected that very large demand will build up to meet the requirements of banks, vaults, industrial security areas etc.

The intruder detector consists of two units, the sensor unit and the alarm unit. The sensor unit consists of a low power CW Gunn oscillator as transmitter, an antenna unit and a printed circuit assembly mounted inside an aluminium case. The antenna side of the unit is covered with a fibre glass radome. All circuit components are solid state to ensure a high degree of reliability and a long working life. The alarm system normally operates on AC mains. A stand-by DC power source, contained within the equipment, is automatically brought into circuit in the event of power failure. This ensures continuous operation of the sensor.

The Gunn oscillator transmits RF power at 3 cm wave length (X-band). The return signal from a moving object will be shifted in frequency due to doppler-effect. A portion of the transmitted RF power also leaks through into the crystal mixer. The difference frequency obtained by mixing the leakage RF power and the return signal is amplified to a proper level to trigger an audible alarm device.

The Defence Electronics Research Laboratory, Hyderabad has fabricated two prototypes with the following technical features. Their performance has been found satisfactory.

Technical Features

Frequency	X-band (10,000 MHz)
RF source	Gunn oscillator
RF power output	Less than 10 mW

RF radiator	Horn antenna, Pyramidal
Antenna gain	13 db approximately
Duplexer	Three port wave guide circulator
Zone of coverage	50°x40° (in perpendicular planes)
Range of intrusion	80 metres approx. at maximum sensitivity
Power requirement	12 v 3 Watts
Receiving system	Crystal mixer, LF amplifier, Alarm Unit
Power unit	12 Volts DC/220V, 50 Hz
Size of sensor unit	20 x 11 x 16 cm
Size of alarm unit	15 x 15 x 8 cm

The main electronic components required are resistors, capacitors, semi-conductor devices and microwave components. All these components are indigenously available except microwave diodes which will have to be imported.

The major items of equipment required are lathe, drilling machine, cutting machine, printed circuit fabrication unit, sheet metal working facilities for making aluminium cabinet and other fixtures. All these are indigenously available. The test instruments required are X-band wave meter, X-band power meter, audio oscillator, oscilloscope, multimeter regulated power supply. These are indigenously available.

It is estimated that a plant capable of producing 100 detectors per annum on one shift basis would need an investment of Rs.0.3 million excluding land and buildings. The plant can employ about ten persons.

New Machinery and Equipment

ELECTRONICS AND ELECTRICAL EQUIPMENT

Data Entry System

The Electronics Corporation of India Limited (ECIL), a Government of India enterprise, offers versatile range of Data Entry Systems, including the direct key to floppy system, that meet low, medium and large volume data entry requirements of computer users.

Key to floppy and superior multi-terminal data entry system (MTDES), with a provision to connect four to 32 key stations, are designed to replace the fast fading conventional card-based computer systems.

Magnetic tape replaces the card as a media to create error-free data. Power fluctuations and failures hardly affect system performance.

ECIL's systems are in three models-single terminal key to floppy system (DE-5802) and two types of MTDES-TDC-800 with four key stations and TDC-1200 with 8 to 32 key stations.

A 16 character alphanumeric display, key board and a floppy drive go in ECIL's key to floppy system. Each unit can be independently handled and the system has facility to enter, verify and update data.

TDC-800 is a specially designed centralised data entry system for low volume users. Its basic system has a central processor with 24 k bytes memory, 4 key terminals, each with a key board and a display screen of 240 characters, a magnetic disc with capacity of 3,800 records of 120 characters, a 7 track magnetic tape and a supervisory terminal.

Headlight Doubler

Headlight doubler is meant for safe night driving of vehicles and can be used on all 12 and 24 volt vehicles including Premier, Ambassador, Jeep, Matador, Tata, Ashok Leyland, etc.

It makes it possible to double the intensity of light from the headlight without changing the bulbs or the wiring. It enhances the intensity of light of the headlights in the normal course too, by delivering extra voltage to bulbs. It renders the use of headlight relay unnecessary. It has been designed so as not to have any adverse effect on the bulbs.

One or a pair of extra lamps, say fog lamps etc., can also be connected with the device using the same switch.

While the vehicle is running in normal situation with the Doubler switch off and headlights at full, on observing an on-coming vehicle if you want to dip your headlight, you may use the dipper switch. In this position, to double the headlights, you may pull 'On' the Doubler Switch (you can again dip your light putting the doubler switch 'Off'). To bring back the headlights to full, use the dipper switch again.

In the normal condition when the vehicle is running at full headlights, you can enhance the light intensity by pulling 'On' the doubler switch.

Details from Jain Electronics Industries, Jaipur-302 004.

Portable Cardiac Care System

Hyderabad Electronic Instruments Limited, and the Andhra Pradesh Industrial Development Corporation have introduced a completely integrated cardiac care system.

It consists of a DC defibrillator with a synchroniser which can deliver up to 500 Joules energy, memory monitor with freeze facility, digital (LCD) heart rate meter with alarm settings and a 50 mm recording width standby recorder. The instrument is portable, weighing only 14 kgs. It operates on both AC mains and built-in rechargeable batteries.

The system has several features such as automatic hard copy facility on the onset of distress. It also has a special test pad to test the defibrillator periodically. It can be used for bedside monitoring in an ICCU or in an operation theatre or in a catheterisation laboratory.

The system can be modified to take the Goldberger 7 lead ECG program for recording and also be adapted for telemetry. The system is completely modular and as such can be easily serviced.

The Cardel 6600, it is claimed, can be bought even by a small hospital. It conforms to American Heart Association specifications. The system is distributed by Lawrence and Mayo (India) Pvt. Ltd.

Further information from: Hyderabad Electronic Instruments Limited, Industrial Development Area, Jeedimetla, Hyderabad-500 854.

Semi-conductors

Nayar Electronics Private Limited, Bombay, is manufacturing a wide range of power semi-conductors. Its 2N3055 series of power semi-conductors include the 15 ampere NPN power transistor with BVCEO of either 55 volts or 140 volts with excellent secondary breakdown characteristics.

These transistors are hermetically sealed in TO-3 and TO-66 packages. The PNP complement is also available. They are designed for intermediate power handling in industrial and commercial equipment such as power supplies, series and shunt regulators and a host of other applications.

Solid State Pressure Transmitter

Philips has introduced a solid-state pressure transmitter which offers significant advantages in performance, application and reliability over conventional pressure measurement systems. It is also price competitive. It features direct pressure/electrical signal conversion, thereby completely eliminating mechanical transmission with inherent problems such as hysteresis and susceptibility to vibration.

Based on a silicon-chip transducer, incorporating a wheatstone bridge circuit, the unit operates on a piezoresistive effect. This gives a high bridge-sensitivity even with minimal displacement. High sensitivity allows the chip to be protected by a separating diaphragm, so it can work with the most corrosive media. All parts making contact with the media to be measured are cased in stainless steel.

Being solid state, the unit is highly reliable, impervious to overload conditions, extremely accurate and insensitive to vibrations. It is supplied encapsulated in its rugged steel housing, so that even the severest vibrations will not affect its performance.

An intrinsically safe version can be supplied for applications in hazardous areas. The unit is, therefore, suitable for any application where pressure has to be measured.

It is supplied with pressure spans from 0...0.25 to 0...160 bar; for application in pneumatic environments a hose coupling is possible, Output signal is 4...20 mA.

It is envisaged that the transducer's combination of electronic reliability and accuracy and price competitiveness will ensure its adoption by industries which have previously relied on mechanical systems.

Further information from S and I Dept., Peico Electronics and Electricals Ltd., Shivsagar Estate, Block - A; Dr. Annie Besant Road, Worli, Bombay-400 018.

ENGINEERING EQUIPMENT

Banding Systems: Worm Drive Tightening

A re-usable banding system, called stranglehold, suitable for a wide range of applications, has been introduced by Elms Lightning Tools and Fasteners Ltd. Supplied in standard 100 ft. dispensing packs, it takes only a few seconds to form a worm-drive or adjustable toggle clip which can be used in almost any situation where band fastening is required.

A major advantage claimed for the system is its versatility. There is no need to carry stocks of standard size clips; no need for the special tools associated with conventional banding systems, and no waste when a band or strap has to be renewed. Based on an 11 mm. wide heavy duty threaded band of stainless steel or zinc plated mild steel, there are two simple fastenings: a worm-drive screw available in boxes of 50 or 100 and a quick release toggle.

In addition to a slotted screw on the work-drive clip, a hexagonal head slotted screw is available. In applications where the system might be exposed to vibration or where the band has to be regularly removed and replaced, a housing with a captive screw has been developed.

To assemble a band, the required length is cut off, the reel and one end is inserted into screw housing or toggle clamp and folded under. The band is then placed around the workpiece and the free end inserted into the fastening mechanism. The work-drive is tightened with a screw driver or nut-runner while the toggle clamp version incorporates a ratchet which permits fine tension adjustment before locking by a lever.

According to the makers, the system offers economy in use, average cost being 6 pence per ft. of banding. A complete 12 in. dia. clip would cost about 30p. For complicated assemblies, several bands can be linked together to allow accurate tensioning around irregular shapes.

Inquiries to: Elms Lightning Tools and Fasteners Ltd.,
Lightning Way, Alvechurch Road, Birmingham 31, U.K.

Hydraulic Surface Grinder HSG-2A

Automatic working of table and saddle is exclusively achieved by hydraulic pressure through cylinder and piston. Hydraulic oil is delivered to the Control Block by a gear pump with independent electrical drive. Speed of the table is infinitely variable between 0-60 ft/min. by the speed selector knob. Reversal of the table movement is extremely smooth due to dual controls and shock absorber. Desired working length is obtained through easily movable stops.

The feed is obtained during every change-over of table movement on the left and infinitely variable between 0-06 inch. Transverse working range can be adjusted through two stops. Table reverses automatically at the end of transverse stroke, thereby enabling a work piece to be ground continuously. A hand wheel with a micrometer dial is used for setting movement of saddle by hand.

Main Features

- Robust and simple in construction
- Full hydraulic control for longitudinal and transverse movements of working table
- Infinitely variable longitudinal and transverse feeds covering a wide range
- Simple controls for operations
- Strong ribbed pedestal with accurate 'V' and flat guideways
- Effective dust protection of the table guides
- Automatic lubrication of guideways
- Independent drives for hydraulic pump, grinding spindle and rapid feed of wheel head
- Wheel head vertical movement adjustable to 0.00008 inch.

Technical Data

Working surface of table	600 x 200 mm	24 x 8 inch.
Longitudinal movement of table	625 mm max.	25 inch max.
Cross movement of table	225 mm max.	9 inch. max.
Vertical movement of wheel head	250 mm max.	10 inch. max.
Table speed infinitely variable between	0-18 m/min	0-60 ft/min.
Cross feed infinitely variable between	0-15 mm	0.6 inch.
No. of 'T' slots in the table	3	3
Size of 'T' bolts	12 mm	1/2 inch.
Wheel size	250 x 25 x 75 mm	10 x 1 x 3 inch
Wheel speed	2320 rpm	2320 rpm
Floor space required (approx)	2450 x 1550 mm	97 x 62 inch.
Nett weight (approx)	2000 kg	4200 lbs
Grinding wheel motor	2 HP/2900 rpm	400/440 volts 3 phase 50 cycles
Hydraulic motor	2 HP/1430 rpm	
Lifting motor for wheel hand	0.25 HP/1430 rpm	

Standard Accessories - One Magnetic Chuck

- One wheel extractor nut
- One diamond tool holder

Special Accessories (at extra cost)

- Wet Grinding Attachment
A self-contained unit complete with motorised coolant pump
- Balancing Mandrel

Cost: Approx. Rs. 80,000/-.

Further details from: Director General, Ordnance Factories (Ministry of Defence) 6, Esplanade East, Calcutta.

NC Lathe: Slant-bed Design

Now available in the UK through Selson Machine Tool Co. Ltd. is a precision slant-bed NC lathe by demoor, of Belgium. Designated 750 NC, it has a swing of 750 mm. dia. over the bed, 520 mm dia over the carriage and will accommodate, between centres, workpieces upto 2,500 mm long and 5,000 kg. in weight. Spindle bore is 162 mm. dia. and spindle speeds are in the range 20 to 1,250 rpm. Main drive is provided by a 40 KW d.c. motor.

The carriage has traverses of 470 mm. and 1,500 mm in the transverse and longitudinal directions respectively, with resolution of 0.001 mm. and repeatability of ± 0.0025 mm.

The tailstock, which is hydraulically operated, has a 120 mm dia. quill having a stroke of 200 mm, a No. 6 6MT taper, and is designed with a fail-safe feature in the event of hydraulic leakage.

The spindle, supported in one single and one double bearing, has a 240 mm dia. front journal, and allows for the mounting of four alternative types of chuck: USAS A.2-11 in. USAS a.1.15 in., Camlock No.15, DIN 55022 No.15. There is the possibility also of adapting a second chuck at the rear of the spindle to facilitate (without use of tailstock) the threading of long and thin wall tube without any length restriction. Spindle speeds are steplessly variable over the full range, in both forward and reverse directions, without the need to stop the spindle.

Feed drive to the carriage is through ball screw with pre-loaded double nut and d.c. motor. Each axis motion is controlled by a transducer, while a third transducer on the main spindle allows for the cutting of parallel and taper threads. Automatic centralised lubrication to the bedways and cross slide is a further feature. The 390 mm. dia. electrically operated 12 station turret is of the vertical disc type and has the capacity for mounting six external tools and six boring bars each provided with direct coolant supply through the tool holders. Accurate indexing is achieved by a Hirth coupling.

The machine is equipped with GE1050TL CNC system, but can be offered with other controls to suit customer requirements.

Inquiries to: Selson Machine Tool Co. Ltd., Airfield Industrial Estate, Cherry Garden Lane, White Waltham, Nr. Maidenhead, Berks, U.K.

Pneumatic Hand Grinders

A redesigned range of heavy duty, horizontal pneumatic hand grinders has been introduced by the Power Tools Division of Comco Air Industrial Ltd. This range of products has a low operating noise level and safety controls and comprises two models; the 4HGA version which has a 4in. abrasive wheel suitable for operation upto 8,500 r.p.m. and the 6HGA, a 6 in. wheel grinder for speeds upto 6000 rpm. The operating speeds are chosen to give the best cutting action of the wheels, which is said to be consistent with the long life of the tool. The two grinders are designed for a variety of functions including fettling of welds, castings, and general purpose fabrication work.

A feature of the redesigned range is the silencer device which reduces the noise generated by the pneumatic system during grinding. It also eliminates the high rundown noise normally associated with larger machines.

The HGA pneumatic grinders also incorporate a twin control safety throttle. The tool will remain safe and inoperative should the trigger be accidentally touched. In order to actuate the drive system, both the hand trigger and finger controlled push button must be depressed.

Inquiries to: Compair Industrial Ltd., P.O. Box 7, Broom Wade Works, High Wycombe, Bucks, U.K.

Industry Roundup

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

GLASS INDUSTRY

Glass Container Industry:

Though glass is yet to be defined chemically, the first glass container is reported to have been made in Egypt as early as 1500 BC. The process and operation of glass-making has gone through various phases of change - from manual to semi-automatic and finally to automatic systems.

In many applications, plastic and other materials, such as, paper, wood, metal and fibre have been used as a substitute of glass, but, by and large, the inherent excellence of glass as an ideal packing material has given it a very high value of consumer acceptability. Its chemical inertness, non-permeability and clarity, confer upon glass the quality of perennially-rising commercial usability.

The first fully automatic glass container unit was established in India in 1949 when Alembic Glass Industries Ltd. of Baroda installed one Hartford-4-section I.S. machine. The industry which had been shying away from a mechanised process

finally gained confidence and started installing automatic machine. Until a few years ago, the quality of indigenous glass bottles was poor, the finish was unsatisfactory, the containers were not of uniform dimension and in some cases, did not possess the desired chemical durability. Many of these defects have now been overcome by ushering in automation in the industry.

Glass bottles are required mostly for packing of drugs and pharmaceuticals, milk, brewery and distillery products and soft drinks. The use of automatic bottling and capping machines in these industries has created a substantial demand for bottles made on automatic machines.

There are 34 units engaged in the manufacture of glass bottles and miscellaneous glass wares with an installed capacity of about 4,22,430 tonnes per annum. An additional capacity of 1,92,700 tonnes is covered by Industrial Licences/letters of intent/registration with Directorate General of Technical Development. Out of this a capacity of about 18,000 tonnes is likely to materialise by the end of the Fifth Five Year Plan, thus raising the installed capacity to 4,40,430 tonnes per annum.

The production of bottles on automatic machines from 1966 onwards, along with the installed capacity and percentage utilisation of capacity is tabulated below.

Year	Installed capacity unit	Production tonnes	Percentage utilisation of capacity
1966	1,62,000	1,16,700	71
1967	1,62,000	1,10,000	67
1968	1,72,000	1,15,000	67
1969	1,72,000	1,36,500	80
1970	1,80,000	1,25,500	70
1971	1,90,000	1,45,000	76
1972	2,14,000	* 1,70,000	80

* This figure includes the production of semi-automatic units also which is estimated to be between 50 to 60 thousand tons.

Based on the above pattern of growth and taking into consideration the increasing demand for machine made bottles required for packing of milk, beer and soft drinks as given above, and similar rise in the demands for bottles for drug, pharmaceutical and cosmetic industries, the future growth in demand is estimated to be fifteen per cent per annum. The requirement of bottles for various consuming industry is estimated for 1978-79 as follows.

Consuming Industry	Requirement of bottles in tonnes	
	1973-74	1978-79 estimated
Milk Schemes	35,000	70,000
Pharmaceutical Industry	60,000	1,20,000
Breweries	30,000	1,20,000
Oils, Cosmetics & Food etc.	35,000	80,000
Soft Drinks Industry	25,000	50,000

The above requirements have been estimated on the basis of the tentative programmes for the development of these industries. The economic capacity of production by automatic machines has been accepted at 18,000 tonnes per annum involving three machines of 6,000 tonnes capacity each.

The production of glass bottles and other glass containers and pressed wares during last four years was as under:

Year	Production in tonnes
1974	2,20,854
1975	2,12,330
1976	2,28,700
1977	2,50,000
1978	2,75,000

There are no imports of glass bottles. Exports of glass bottles and vials during last three years were as under:

Year	Value in Rs. lakhs
1973-74	143.14
1974-75	176.00
1975-76	291.27

The demand for glass bottles had been assessed by the Task Force for glass and ceramic Industry at 3,00,000 tonnes per annum by 1978-79 for which capacity of 4,00,000 tonnes would be required. According to rough estimates made by DGTD the

demand of glass bottles would be of the order of 3-5 lakhs tonnes per annum, by 1982-83, requiring an installed capacity of 4.7 lakhs tonnes. Since sufficient capacity has already been approved, licensed for manufacture of glass bottles, there is no scope for further licensing of capacity in this field.

The know-how required for setting up of glass bottle manufacturing units is available indigenously. Automatic bottle making machines are available in the country and there is adequate capacity to meet the demand of the industry. Fresh schemes can be considered on merits in the States and at locations where there are no glass factories and requirement of glass bottles is substantial. Export oriented schemes can also be considered on merits.

Fibre Glass Industry:

Fibre glass finds application in a number of areas such as electrical insulation, reinforced paper rubber and thermoplastics and protective screens. Fibre glass can also replace asbestos fibre and asbestos cement products. Fibre glass also finds application in the form of glass fibre reinforced plastics.

There is at present one unit in the country engaged in the manufacture of fibre glass with a licensed capacity of 1,000 tonnes per annum. Fibreglass Pilkington Ltd of Bombay in technical collaboration with Fibreglass Ltd (UK) have been producing continuous filament fibreglass yarn, glass wool and glass tissues since 1965. With the availability of this basic material, a new field of fibre glass insulating products has been opened up.

The most important use of glass fibres is in making fibre glass-reinforced plastics (FRP). It combines design flexibility, lightness, high strength, corrosion resistance and electrical

properties and is widely used in transport, construction, marine and electrical industries as well as in making rocket nose cones and other defence equipment, domestic appliances and sports goods. FRP has already more than 20,000 end uses.

The production of fibre glass during the last seven years was as under:

Year	1970	1971	1972	1973	1974	1975	1976	1977
Production in tonnes	300	360	500	-	651.85	426.00	844.23	850.00

An additional capacity of 35,800 tonnes/annum has already been approved. The demand for fibre glass has been estimated by DGTD at 15,000 tonnes per annum by 1982-83 at international prices. According to the estimates recently made by NIDC, the demand for fibre glass would be about 34,500 tonnes within the next 5 years. Since the adequate capacity has already been approved, there is no scope for approving further capacity for this item at this stage.

The glass and glassware industry which has a creditable performance in terms of growth in output over the last seven years is saddled with sizable unutilised capacity in major products, such as, sheet glass, laboratory glass, glass shells and bottles and vials.

The unutilised capacity in 1978 was 52.8 per cent in laboratory glass, 25.9 per cent in sheet glass, 20.5 per cent in glass shells and 40.7 per cent in bottles and vials. A redeeming feature has been the commendable achievement of more than 110 per cent utilisation of capacity in vacuum flasks.

The important problem of large unutilised capacity in the glass industry may remain unresolved despite the fact that the export prospects for some of the glass products-sheet glass, vacuum flasks, refills, glass beads, false pearls, bottles, vials and wired glass - are bright due to the expanding world markets for Indian glasses.

The following table illustrates the percentage capacity utilisation since 1971

Year	Laboratory glass	Sheet glass	Glass shells	Bottles and vials
1971	12.4	75.2	83.0	75.0
1972	25.6	86.8	103.5	67.3
1973	28.9	76.0	88.2	67.9
1974	28.8	66.8	89.7	72.2
1975	27.4	64.8	78.8	66.7
1976	30.6	75.3	91.9	61.7
1977	36.8	83.3	85.0	59.2
1978	47.2	74.1	79.5	59.3

Glass beads, glass tubes, scientific laboratory glassware, micro-cover glasses and slides for microscopes, glass bangles, glass hollow ware by mouth blown and/or semi-automatic process, glass pressed wares are reserved for small scale sector.

3. Import and Export

The types of glass which have to be imported include mainly lead glass, tubes/rods for lamp industry, laboratory glass, bends, optical glass and glass fibre articles. The items which the glass industry has been progressively exporting are bottles, phials, bangles, unworked glass, laminated sheet, figured and wired glass, and glass inners for vacuum flask. In recent years, India has been exporting pharmaceutical containers to Pakistan, Sri Lanka Africa and Australia. Sheet glass was exported to the USA for the first time in 1966 and vacuum flask shells are being exported in large volume to European and middle eastern countries.

Under the export oriented policy of the Government of India, the glass industry is pushing ahead to gain a foothold in the international market. This fact can be verified from the following export and import figures of glass industry in India.

(in lakhs of rupees)					
Year	Export	Import	Year	Export	Import
1947-48	26	367	1970-71	216	181
1951-52	21	214	1971-72	163	220
1956-57	27	180	1972-73	280	270
1961-62	25	132	1973-74	475	
1966-67	44	125	1974-75	589	
1967-68	59	187	1975-76	843	
1968-69	121	147	1976-77	1170	
1969-70	133	129	1977-78	1350	

4. Raw Materials:

The main raw materials required for glass making are:

(1) Silica in the form of glass sands or quartzite (ii) Soda ash and (iii) Limestone. Several other oxides, such as, Al_2O_3 and B_2O_3 and colouring and finishing ingredients, such as, cobalt oxide, nickel oxide, arsenious oxide, manganese dioxide, selenium, sulphur, cadmium sulphide etc. are also required by the industry. Felspar, magnesia, lead oxide, barium oxide, etc are introduced in the glass batch for obtaining particular characteristics while carbon and nitre are added as reducing and oxidising agents respectively.

Sand is one of the essential substances which take the vital role in glass formation. The principal constituent of glass sand is silica (SiO_2) which is also known as the "network-glass-formers". This silica is the most important and necessary constituent of every commercial glass and occurs in nature both in the free state and in the forms of its compounds, ie. silicates. The varieties of natural silica are:

- 1) Crystalline Silica, eg. quartz, tridymite, cristobalite
- 2) Cryptocrystalline silica, eg. flint, chert, chalcedony, agate, jasper and
- 3) Amorphous silica, eg. opal.

The chief source of silica is quartz which occurs in igneous, sedimentary and metamorphic rocks. The purest variety of quartz is known as rock crystal where SiO_2 percentage is more than 99. Besides quartz the suitable sources of silica are sand, sandstones and quartzites. The quality of sand is judged by the presence of main impurities, such as, oxides of iron (Fe_2O_3) and titanium (TiO_2). Both of these oxides impart

colour to glass. Iron oxide (Fe_2O_3) is the most objectionable impurity as even 0.1% produces green glass. This green colouration can only be decolourised if the amount of Fe_2O_3 in sand is 0.08% or less. Depending upon the quality of glass to be produced the following are the permissible limits of Fe_2O_3 and TiO_2 in glass sand.

----- Maximum limits (dry weight basis) -----		
	$\text{Fe}_2\text{O}_3\%$	$\text{TiO}_2\%$
Optical glass	0.008	0.10
Best quality colourless glass	0.02	0.10
Colourless bottles and general glass wares	0.06	0.10

Good quality silica sand is available from sand stone beds in the Bargarh-Sankargarh area near Allahabad. Other deposits are situated at Naini, Hathras, Shikohabad & Bajhoi (U.P); Sowai Madhopur and Jhir in Jaipur district and Barodia in Bundi district (Rajasthan) Rajmahal and Chotanagpur (Bihar), Burdwan and Bankura (West Bengal) and Vindhyan quartzite (Madhya Pradesh); quartz deposits of Panchmahal and Baroda district (Gujarat). In the south Shertallai sand (Kerala) is suitable for glass making. Other deposits in the south are located in Hyderabad district (Andhra Pradesh); Salem district (Tamil Nadu) and Gulbarga district (Karnataka). Other new deposits in Gujarat, Dandakaranya (M.P) and Maharashtra have been located.

Soda ash is another principal raw material for manufacture of glass and acts as a flux for reducing the melting temperature.

At present there are five factories producing soda ash;

- 1) Tata Chemicals, Mithapur, Maharashtra.
- 2) Dhrangadhra Chemicals, Dhrangadhra, Gujarat.
- 3) Saurashtra Chemicals, Porbandar, Gujarat.
- 4) Sahu Jain Chemicals, Mughalsarai, U.P.
- 5) Jayashree Chemicals, Ganjam, Orissa.

One more soda ash factory is scheduled to be set up at Haldia (West Bengal). The soda ash factory which was to be established at Durgapur (West Bengal) by the Tatas did not materialise. However even with these factories soda ash is still in short supply, specially in the eastern region of the country and setting up of additional capacity is urgently needed.

Lime stone is required for obtaining calcium oxide, an essential ingredient in glass making. The most important deposits are at Katni and Satna (MP); Gotan, Sojat and Ghatra (Rajasthan), Dehra Dun (U.P) and Sankaridurg area Tamil Nadu.

Calcium oxide is also available from good quality calcite deposits near Manda (Rajasthan); Nawanagar, Porbandar and Palitan (Gujarat) and from marble deposits in Makrana (Rajasthan).

Calcia along with magnesia may also be obtained from dolomite deposits in Jabalpur (M.P), Jaintia near Jalpaiguri (West Bengal), Dhar and Alwar (Rajasthan) and Sankaridurg (Tamil Nadu).

5. Manufacturing Process:

The manufacturing procedures may be divided into four major phases: 1) melting 2) shaping or forming 3) annealing and

4) finishing. Typical manufacturing sequences can be broken down into the following unit operations (oo) and chemical conversions (ch).

- Transportation of raw materials to plant (OP)
- Sizing of some raw materials (OP)
- Storage of raw materials (OP)
- Conveying, weighing, mixing, and feeding raw materials into glass furnace (OP)
- Reacting in furnace to form the glass (ch)
- Burning of fuel to secure temperature needed for glass formation (ch)
- Heat saving by regeneration or recuperation (OP)
- Shaping of glass products (OP)
- Annealing of glass products (OP)
- Finishing of glass products (OP).

Glass may be shaped by either machine or hand moulding. To reduce strains, it is necessary to anneal all glass objects. Annealing involves two operations: 1) holding a mass of glass above a certain critical temperature long enough to reduce internal strain by plastic flow to less than a predetermined maximum and (2) cooling the mass to room temperature slowly enough to hold the strains below the same maximum. All types of annealed glass must undergo certain finishing operations which are very important. These include cleaning, grinding, polishing, cutting, sandblasting, enameling, grading and gauging. Although all these are not required for every glass object, one or more is almost always necessary.

6. Research and Development:

The Central Glass and Ceramic Research Institute (CGCRI) at Calcutta is the main Research and Development Centre on glass in the country. The Institute has made some notable contributions towards attaining self-sufficiency in glass and glassware. The CGCRI developed the know-how for production of high quality optical glass by the classical pot-melting or intermittent method and put up in 1961 a pilot plant for 10 tonnes annual capacity which has since been meeting a part of the requirement of the defence and the optical instruments industry in the country. The Institute's pilot plant produces 26 varieties of good quality optical glass and has so far supplied glasses worth more than Rs.50 lakhs.

The Institute has also been supplying the defence, with periscope prisms used in armoured tanks and infrared filters for use in strategic equipment. Laser glass, used in microdrilling, cutting of brittle materials, optical surgery etc. has been developed at the Institute recently. It has developed glasses suitable for sealing with 'Kovar' alloy, tungsten metal and mild steel electrodes. Some of the other important contributions of CGCRI in the field of glass are signal glass of various colours, sun-glare glasses, eye-protective glasses for welding operations etc. Researches carried out at the Institute have also helped in location of good quality glass raw materials.

7. Conclusion

Glass is one of man's most valuable and versatile materials. Although it is one of the oldest materials, known, its employment as a material of construction for the chemical industry is of

comparatively recent origin. Since the development of low expansion borosilicate glass in the 1920's, it has occupied a vital place in the laboratories of experimental scientists of all disciplines. During recent years, glass pipelines and process plants are widely used in handling corrosive chemicals, food and dairy products, pharmaceuticals, detergents, wines and spirits and many other products. Complete glass plants for the various unit operations like distillation, absorption, extraction, heat exchange duties etc. are available now in our country. Borosilicate glass is unattacked by practically all chemicals except hydrofluoric acid, phosphoric acid and hot strong caustic solutions. As a material of construction glass has some disadvantages. It cannot be used for high temperature and high pressure applications. (Concluded) (KSDR)

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Current Technical Literature

Copies of articles/documents listed in this section are available on payment of Rs.5/- for the first 5 pages or part thereof and Re.1/- for every subsequent page of the photocopy or xerox copy of the article/document. While placing the order, please mention the CTL number of the SENDOC Bulletin.

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SCIENCE AND TECHNOLOGY

Technology Transfer

272. GOTO K: Prospects for technology development in 1980.
Chemical Economy & Engineering Review, 1979, 11(1&2), 7-11.

Highlights the future direction of technology development by discussing some basic matters pertaining to data processing technology and society, environmental problem and science and technology, technological options on resource and energy problems, international developments in technology development and problems on the future of technology oriented civilisation.(BS)

273. SIDHU G S: Some suggestions for an integrated approach to indigenous development import and absorption of technology. Colour & Chemical Weekly, 1979, 4(46), 29-31, 33, 34.

274. SINHA A K: Intensive extension technology. Bombay Market 1979, 42(6), 99-104.

Describes the objectives of intensive extension technology (IET), salient features, organisational structure, programme scheduling, infrastructural support etc.

RESOURCES

Energy Sources

275. BHATTACHARYA B C: Economic design of gobar (or bio) gas plant for rural communities. Chemical Age of India, 1978, 29(5), 301-330.

The importance and utility of gobar gas plants for village communities are well understood today. Research work is being continued to reduce the retention time in the digester. But not much effort has been reported in the construction of low cost plants for the farmers. In this article, the author has detailed the construction of a low cost bio-gas plant. With cost analysis, it has been shown that the new design will require only about 50 per cent of the investment on an existing model of the same capacity. Moreover the new design will provide neat and clean surroundings, unlike the presently implemented design.(AA)

276. MAGAL B S et al: Mechanical energy storage system for a 10 KWh solar power pack. Electrical India, 1979, 19(3), 35-39.

An energy storage system is a necessary adjunct to any solar power generating unit, to ensure continuity of supply. An attempt to design a 400 KWh flywheel storage using indigenous technology, material and equipment available in developing countries for a 10 KWh power pack is made. A thermal energy storage system for the above power

pack has also been designed and these two systems have been compared with respect to their impact on collector area, generator capacity and capital cost. This exercise indicates that a flywheel energy storage system is feasible to build, operate and maintain in a developing country using intermediate technology; but it is very costly when compared with hot water storage system.(AA)

277. PRAKASH O: Development of new energy sources. Engineerir World, 1978, 8(9), 87-99.

The growing worldwide awareness about the fast depletion of reserves of oils, natural gas, coal, firewood etc. has caused intensive search for inexhaustible sources of energy. The recent oil crisis has given impetus to this search. New energy sources like solar, wind, geothermal & tidal energy, which are inexhaustible hold a big promise for the mankind. In this article, the basic principles of operation, characteristics, applications, advantages, limitations, R & D work & problems in the development of solar, wind geothermal & tidal energy are discussed.

278. RAJIVA & VATS R K: Solar oven as a substitute to solar cooker. Invention Intelligence, 1979, 14(11), 442-450.

Describes the design and construction of a solar oven, which overcomes the inherent disadvantages of the solar cooker, of constant attendance in the Sun and its high cost.

FOOD AND ALLIED INDUSTRIES

Animal Feeds

279. -----: Cattle feed - A feasibility study. Industrial Researcher, 1979, 6(2), 83-90.

At present, there are about 120 units manufacturing various specifications of cattle feed with a combined installed capacity of about 1.8 million tonnes per annum. The article emphasises that the demand for cattle feed is likely to grow substantially in the next 5-6 years and small plants with a total investment of about Rs.10 lakhs can be set up in rural areas.(JBS)

280. SAXENA U C: Producing quality compounded feeds. Poultry Guide, 1979, 16(7), 27-29.

Focusess on the feed compounding techniques and its needs. Ways of compounding and use of unconventional feed ingredients are reported.(MKSS)

Confectionery

281. BONGIRWAR D R et al: Development of high protein ready-to-eat foods from defatted groundnut and soybean by extrusion cooking. Indian Food Packer, 1979, 33(1), 37-53.

An indigenous laboratory scale extrusion cooker with arrangement for controls of extrusion temperature, retention time, speed of mixing and other factors during extrusion has been found

to be quite suitable for preparation of protein enriched ready-to-eat foods from combinations of defatted groundnut/soyflour and cereal/gram flour. Optimum conditions of extrusion cooking for defatted groundnut and soyflours have been reported. Organoleptic evaluation and storage studies of the experimental samples show an acceptable shelf-life of over one year in aluminium laminate pouches (400 gauges). The feasibility of the process for large scale processing has been discussed.(AA)

282. BRIGHT H: Importance of flour specifications in the biscuit industry. Indian Baker, 1979, 9(2), 25, 27-29, 31, 33.

Discusses flour quality for biscuit industry in Asia including the range of shortening and sugar percentage.(MKSS)

283. MORRIS N: Country-style cakes. British Baker, 1979, 176(24), vi, viii, x, xvi.

Recipes and processing data of date and honey cake, harvest fruit cake, Dunster spice cake, and cherry nut cake are reported.(MKSS)

284. STEELE B O B: Solvent extraction of peanuts. Oil Mill Gazetteer, 1979, 83(12), 26-30.

Physical, chemical, nutritional and microbiological analysis of meal with process flow chart for edible peanut flour and grits are given. Four general methods and a revised method for extraction are given, with problems faced in processing and their solution.(MKSS)

Fruit and Vegetable Products

285. DURGAPAL B E et al: Utilisation of fruit wastes. Agriculture and Agro-Industries Journal, 1978, 11(11), 3-7.

Highlights the extraction of various valuable products from fruit wastes hitherto unutilised.

(MKSS)

286. ROY S K & SINGH R N: Studies on utilisation of bael fruit (*aegle marmelos correa*) for processing-II. Extraction of bael fruit pulp. Indian Food Packer, 1979, 33(1), 5-9.

Extraction of pulp from the ripe bael fruit is the main hindrance to processing. This is mainly due to mucilaginous texture and tendency of the pulp to develop off-flavour and colour. The bael fruit pulp was successfully extracted by addition of water equal to the pulp (with seeds and fibre), adjusting the pH to 4.3 with citric acid (titratable acidity 0.5%) and heating at 80°C for 1 minute. The application of heat not only inactivated the enzyme but also helped in dissolving the mucilage uniformly to provide a homogeneous pulp.(AA)

OILS AND FATS

287. -----: Vegetable oils - A profile for industrial applications. Industrial Researcher, 1979, 6(1), 27-34.

Assesses the demand for vegetable oils emerging from different end-uses and estimates it at 46 lakh tonnes by 1982-83, as against the production of these oils in 1978-79 around 26 lakhs tonnes (JBS)

288. BASSETT H J: A technical overview of fats and oils. Cereal Foods World, 1979, 24(1), 7-9, 24-25, 29-30.

An indepth discussion on fats and oils, their byproducts, special qualities and their uses in foods, is given.(MKSS)

289. KAMATH K S et al: Sunflower seed oil - Physico - chemical characteristics and industrial use. Research and Industry, 1979, 24(3), 168-170.

The potential of sunflower oil as a substitute for the traditional edible oils, currently in short supply, is highlighted. Data are presented on the average physico-chemical characteristics of the oil based on the analysis of a large number of samples collected from different sources. The various industrial applications of the oil are surveyed.(AA)

290. MOTIUK K: Wool wax acids: A review. Journal of the American Oil Technologists' Society, 1979, 56(2), 91-97 (SD & C 27).

Wool wax acids consist predominantly of alkanoic, hydroxy and hydroxy acids. Each group contains normal, iso, and anteiso series of various chain length. Practically all the acids are saturated. The average weight-percent of the various series is based on recently published results.

PACKAGING

291. -----: Plastic packaging for biscuits, bread and cakes. The Indian Baker, 1979, 9(1), 23-25.

Highlights the functional properties of plastic

packages for biscuits, bread and cakes. Special note on permeability, polythene films and polypropylene is presented.(MKSS)

292. CHAUDHARY S L: Corrugated boxes as a packaging material and its attendant costs. Perfectpac, 1979, 19(1&2), 9-12.

Highlights the salient features and advantages in using corrugated boxes as a packaging material. Examines the costs involved and finally makes some recommendations to the Government for improving the industry.(BS)

293. GUPTA R M & NIMBKAR Y S: Plastics for transfusion fluids. Colour & Chemicals Weekly, 1979, 4(50), 35-38.

Reviews the current prospects of plastic containers for intravenous use. Discusses the advantages and disadvantages of polyethylene and polypropylene materials.(MSR)

294. EDWARDS A: New machinery for food packaging. Paper printpack India, 1979, 17(2), 54-56.

Describes the features of newly developed cut and wrap machine and continuous heat sealer.(BS)

295. MACDOUGALL S: A versatile new container handler. Perfectpac, 1979, 19(3), 7-9.

Explains the features of a versatile new container handler that will pack a wide range of powders, granules or chunky products into cans, drums, bottles or cartons at speeds varying from 6000/hour to 14,400/hour.(BS)

296. MAHADEVIAH M et al: Assessment of differential tinplate for canning processed food products. Indian Food Packer, 1979, 33(1), 21-28.

Cans with varying thickness of tincoating on the external surface were assessed to find their suitability for canning processed food products.(AA)

CHEMICAL INDUSTRIES

297. -----: Calcium silicide. Colour & Chemicals Weekly, 1979, 5(3), 46.

A profile on the manufacture of calcium silicide is given. Total cost of 100 TPA cap. unit is estimated at Rs.12,40,860.(MSR)

298. -----: Chlorinated paraffin wax - A feasibility study. Industrial Researcher, 1979, 5(4), 221-227.

For an economically viable unit of 300 tonnes per annum, the cost of the project works out to Rs.10 lakhs. The project offers good profitability prospects.(JBS)

299. -----: Status report on mixing equipment. Chemical Engineering World, 1978, 13(9), 53-67.

Indicates the role of mixers and agitators and highlights about the mixer market and process design. Discusses the bottlenecks in fabrication, operational hazards and special arrangement and designs to overcome these hazards. Also gives the addresses of manufacturers of mixers, blenders and agitators.(KSDR)

300. KHARBANDA O P: Alum. Chemical Weekly, 1979, 24(23), 28-29 & 24(24), 30-31.

Process flow chart and requirements for the manufacture of alum are given. Producers with their capacities, future and present size of alum industry are also given.(MSR)

301. KHARBANDA O P: Calcium carbide. Chemical Weekly, 1979, 24(26), 72-75.

Outlines of the process and requirements for the manufacture of calcium carbide are given. Producers with their capacities and demand for the year 1983 and trends of the industry are discussed.(MSR)

302. KHARBANDA O P: Ethylene glycol. Chemical Weekly, 1979, 24(28), 138-141.

Gives the flow chart and equations involved for the manufacture of ethylene glycol. Presents the demand and techno-economic details and trends in brief.(MSR)

303. REVATHI: Chemical industry today and tomorrow; potential of chemical industry in Bihar I. The Chemical Times, 1979, 6(26), 3.

Presents a report of the study conducted by the National Council of Applied Economic Research on the status and future scope of chemical industry in Bihar.(BS)

304. TRIVEDI H M: 100 Tonnes: Butylated-hydroxy-toluene (BHT).
Colour and Chemicals Weekly, 1979, 5(21), 42-43.

Gives a profile on BHT for 100 tonnes/year capacity
with an investment of Rs.5 lakhs.(SSD)

ESSENTIAL OILS, PERFUMES

305. -----: Aromatic chemicals export prospects. The Chemical
and Polymer Times, 1979, 7(7), 3-4.

Gives the exports of essential oils and aromatic
chemicals during 1973-74 to 1977-78 and imports
of aromatic chemicals during 1973-74 to 1976-77.(KSDR)

306. BHANIM A & JAYARAMAN I: Essential oil of Jodhpur Grown.
Indian Journal of Pharmaceutical Sciences, 1979, 41(2),
80-81.

An essential oil, rich in cineole (93%) has been
isolated from leaves of *Eucalyptus viridis* which
also meets the specifications of principal
pharmacopoeias.(AA)

307. KUMAR S & MADAAN T R: A rapid method for detecting
adulteration in essential oils. Research and Industry,
1979, 24(3), 180-182.

A rapid method involving the use of iodine mono-
bromide-mercuric acetate reagent, is reported for
the detection of adulteration in essential oils.
Most of the market samples, considered to be
unadulterated on the basis of the conventional
analytical techniques, were found adulterated
when analysed by this method.(AA)

308. PATEL A R: Scope for aromatic & medicinal plants. Chemical Weekly, 1979, 24(25), 70-72.

Discusses about the profitable areas of cultivation of medicinal & aromatic plants. Indicates the gross income per hectare that a farmer can get from these plants. Highlights the work done by CIMPO and RRLs in this field. (MSR)

MECHANICAL ENGINEERING

309. -----: Try flow drilling if you need a fix. Machinery and Production Engineering, 1979, 134(3444), 27-30.

Describes the technique of flow drilling process. Examples of the variety of jobs which have been successfully produced with the aid of flow drilling process are also given.

310. HATSCHEK R L: Fundamentals of drilling (Special report 709). American Machinist, 1979, 123(2), 108-130.

311. JABLONOWSKI J: Fundamentals of milling. (Special report). American Machinist, 1978, 122(2), SR 1 - SR 24.

It means more than making a lot of chips. Here is a brief review of the machines tooling, and what happens at the cutting edge, plus an update on the latest technology is given.

312. KAMATH B N: Noise analysis of machine tool drives. Machine Tool Engineer, 1979, (July), 15-20.

The noise analysis technique, described in this paper, proves to be very useful for the machine tool manufacturers and users in order to identify the sources

of noises in the drive and thereby to incorporate necessary modifications, if required, to reduce the noise level. The methodology adopted in the noise analysis i.e. real time analysis technique has been described in this paper with a case study.

313. KARUNAKARAN S: Extrusion-a review. Machine Tool Engineer, 1979, (July), 29-38.

A brief review on hot, cold and hydrostatic extrusion is presented. Lubrication in hot, cold extrusion and fluids for hydrostatic type are described. (SS)

ELECTRICAL INDUSTRIES

314. GANDHI R N: Care and maintenance of electrical equipment in factories. Electrical India, 1979, 19(22), 13-15.

Emphasises the need for maintenance of electrical equipment and important points to be considered where proper care and maintenance is required, taking sub-station main switch board as a typical example. A proforma for maintenance of motor is given. (LKPC)

315. GANGULY S K: Role of materials in designing different types of cables. Electrical India, 1979, 19(3), 13-16.

Describes the factors to be considered in choosing materials for different types of cables for various applications according to specific purposes. (LKPC)

316. KULKARNI D K: Rotating electrical machines research in India need for re-appraisal. Electrical India, 1979, 19(16), 5-7.

Product design, transient performance, communication problems and insulation techniques are some of the

areas in which research can be carried out in rotating electrical machines. (LKPC)

317. SIVATHANU PILLAI A: Sulphur-Hexafluoride (SF₆)-Medium for insulation and EHV applications. Electrical India, 1979, 19(22), 5-7.

Describes the electrical properties of pure SF₆, SF₆ mixtures with other electron attaching and non attaching gases and its application mainly towards gas insulated sub-stations and transmission lines.

318. TEWARI J K: Technical background of fluorescent lamp with a new sketch of light. Indian Electrical Contractor and Trader, 1979, 29(7), 8-11.

Deals with the improved method of coating of fluorescent material in improving the life of fluorescent lamp. (LKPC)

ELECTRONICS INDUSTRIES

319. CHITNIS V T et al: Tunable lock-in amplifier. The Journal of Society of Electronic Engineers, 1979, 23(1), 9-14.

Describes a simple turnable lock-in amplifier developed in the laboratory. It has a tuning range of 10 HZ to 20 KHZ and can be operated in internal reference mode, external reference mode and referenceless mode. In addition to this, the Lock-in amplifier has harmonic detection capability for use in derivative spectroscopy, laser frequency and stabilization etc. The basic scheme, circuit configuration and the operation in different modes are explained.

320. CRANEY P M: Who says electromechanical relays aren't IC compatible? Electronic Products Magazine, 1979, 21(10), 27-30.

Points out the considerations in selecting an electro-mechanical relay, which can interface directly with logic gates, buffers or drives and explains the advantages of electromechanical relay over a solid state relay. (VVR)

321. MARGOLIN B: Time delay relays - DODs, DOPs, and One-shots. Electronic Products Magazine, 1979, 21(12), 35-42.

Describes hybrid time delay relays that combine IC or discrete component timing modules and conventional electromechanical relays and their selection. Sources of time delay relays are given in tabular form. (VVR)

322. SARGUNAR J E et al: Commercial applications of micro processor systems. Electrical India, 1979, 19(13), 9-12.

Presents the applications of micro processor systems in commercial data processing with particular reference to on-line inventory control systems. (LKPC)

323. WADA S: Improved materials expand PTC thermistor applications. Journal of Electronic Engineering, 1979, (147), 66-69.

Describes the characteristics and applications of positive temperature coefficient (PTC) thermistors. (VVR)

324. YATES W: Passive component testing. Electronic Products Magazine, 1979, 21(12), 63-70.

Explains how to test various passive component parameters

such as non precision high volume failures, catastrophic rejections, tolerance, capacitance, diode switching speeds, relay life, etc. and explains the type of equipment available to do these various types of testings. (VVR).

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4. DIC, Dhenkanal, Orissa		Profile on: Hydrated Lime
5. DIC, Raipur, Madhya Pradesh		Profiles on: Mini paper mill, Agricultural implements, camphor, Emery grit (abrasive), Menthol from mint oil, Mini cement plant
6. Ent. Andhra Pradesh		Profiles on: Candles, Brake lining, Mini paper mill Bibliography on: Cement industry
7. Ent. Gujarat		Profile on: Automobile gears
8. Ent. Maharashtra		Profiles on: Coumarin, 8-Hydroxy quinoline, Morpholine
9. Ent. Orissa		Profiles on: Carbon paper, Type-writer ribbon.
10. Ent. Rajasthan		Profile on: Bread manufacture
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S.No.	Enquirer	Service Rendered
13.	MI. Andhra Pradesh	Profile on: Leather hand gloves
14.	SI. Andhra Pradesh	Profiles on: Tyre tube valves, Valves and valve pins, Cattle and poultry feed, Plastic blow moulded containers
15.	SI. Chandigarh	Profiles on: Oxygen industrial gas, Cement castor oil, Wax polish
16.	SI. Maharashtra	Profiles on: Enamelled copper wire, Absorbent cotton, Pilferproof caps, Bolts and nuts, Machine screws, Maize starch, Welding electrodes, Starch from corn, Mild steel pipes, Cement colour
17.	SI. Madhya Pradesh	Profile on: Potassium nitrate
18.	SI. Orissa	Profiles on: Magnesium sulphate, Paraffin wax
19.	SI. Uttar Pradesh	Profile on: Zinc oxide

Note:- Con. - Consultancy Organisation, DIC - District Industries Centre, Ent. - Entrepreneur, M I - Medium Industries, S I - Small Industry.

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The thermocouple is an important sensor used for measuring temperature. The thermocouple develops a voltage which is related to the temperature difference between its hot and cold junctions. Over a small range of temperature variation, the voltage developed by the thermocouple is linearly related to temperature changes. However, for large range temperature measurements by thermocouples the non-linearity of the voltage developed by the thermocouple with respect to the junction temperature difference is to be taken into account during the measurement process. One simple way to solve this problem is to have a non-linear indicating dial for the temperature. A better and elegant way of solving the problem has been developed by the Central Electronics Engineering Research Institute (CEERI), Pilani.

In the method developed by CEERI, the non-linear voltage developed by the thermocouple is converted into a linearly dependent digital output by employing special digital circuits. This linear output can then be applied to a digital voltmeter or a digital panel meter, which will provide the digital indication of the temperature. Taking into account the various possibilities of application of the device, the linearizer is considered to be an excellent support device for the existing temperature measurement/control equipment manufacturers. The know-how developed by CEERI is basically meant for chromel-alumel thermocouples. However, modifications can be made to make this suitable for any other type of thermocouple.

The specifications of the device are:

Temperature range	: 0-1300°C
Linearity accuracy	: $\pm 0.5^{\circ}\text{C}$
Number of segments	: 10
Display digits	: 4 1/2
Resolution	: 0.1°C
Logic levels	: TTL compatible
Maximum frequency of operation	: 2 MHz
Power requirement	: 5V, 0.4A

The equipment required for manufacturing the linearizer are: 5V power supply, pulse generator, frequency counter, DPM/DVM, soldering iron, hand tools, etc. All are available indigenously.

The institute has estimated the demand for the item to be a few hundred pieces per annum. However, it is advised that a new entrepreneur should not take exclusively this item for manufacture. An existing manufacturer in a related line will find it much simpler to absorb the technology and utilise it efficiently.

For manufacturing 100 pieces of the digital linearizers per year, a fixed capital (excluding land and building) of Rs.10,000 and a working capital of Rs.15,000 are needed. However, depending upon the existing facilities available with the entrepreneur, the capital required could be reduced.

The terms for the transfer of know-how are: lumpsum premium, Rs.3,000; recurring royalty, nil; period of licence, 5 years; and nature of licence, non-exclusive.

Electronic Dust Precipitator

This device has been developed by the National Physical Laboratory (NPL), New Delhi, for collection of dust using carona discharge and is suitable for removing airborne dust particles of upto 0.1 microm size at a high efficiency. The device is at present being imported for use in telephone exchanges, hospitals, laboratories, etc.

The electronic dust precipitator consists mainly of ionizer and precipitator chambers. The ionizer is fitted with fine metal wires suspended on insulated supports and a high voltage is applied creating ionized field. The precipitator chamber is fitted with a series of vertical charged plates. When polluted air enters the device, the pollutants pick up charged ions while passing through the field and are trapped in the precipitator chamber by the coulombic force of electro-static attraction.

Models can be designed for specific applications. The most commonly needed model has an air treatment capacity of 1000 to 5000 cfm. Typical specifications of a 1000 cfm unit are as follows:

Dimensions	: 2 x 1 x 2 ft. approx.
Materials	: Aluminium and mild steel
Total weight	: 10 Kg. (approx)
Maximum rated capacity	: 1000 cfm
Efficiency	: better than 94% upto particle size 0.1 micron
Washing	: hot water jet or detergent bath
Pressure drop	: Less than 10 in. water
Input power	: 220 V, 50 c/s 5 W (approx) without blower

The equipment needed are: milling machine, metal sheet cutting, drilling machine, suction pump (reciprocating diaphragm type-100 litre/min), glass flow meter, high voltage measuring device (multimeter upto 30 kV, dc. photoelectric densitometer, etc.

The raw materials required are: selenium high-voltage (HV) condensers: HV insulation pieces of glass, porcelain, etc.; metal sheets of MS, Al, GI, etc.; metal pipes of MS, Al, GI etc; and metal wires of nichrome or tungsten.

The suggested capacity of an economically viable unit is 200 pieces of the precipitator per annum. An engineer, five skilled technicians and two unskilled workers can be employed.

Such a unit would require: fixed capital on land and building, Rs.0.80 lakh; fixed capital on machinery Rs.1.25 lakh; and working capital, Rs.1.75 lakh. The cost of production is estimated at Rs.4,500 per precipitator.

Solid-rotor Brushless Alternator

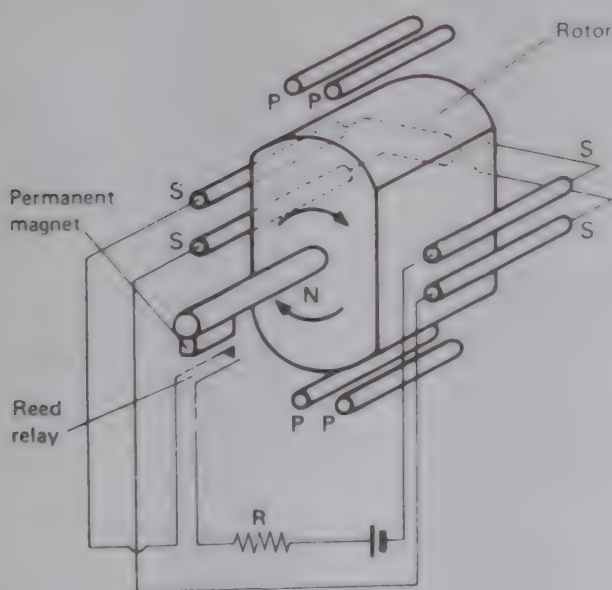
An improved design of self-excited electrical generator that is particularly suitable for use in aircraft has been devised by Dr. D. Midgley of the Department of Electronic Engineering at the University of Hull. The design may also offer useful advantages over conventional automobile alternators.

Conventional alternators require special arrangements to excite the rotor. Usually current from a d.c. supply passes by way of brushes to windings that magnetise the rotor. Brushes and sliprings wear unduly at the altitudes flown by jet aircraft, and in some alternators the problem is solved by using rectifiers

mounted on the rotor. This solution is accompanied by a potential hazard, since it is difficult to check or replace such rectifiers and failure of the electrical supply in a modern aircraft can be dangerous.

Dr. Midgley's proposal for an alternator design avoiding brushes or sliprings involves the introduction of a secondary 'magnetic booster' coil that can use the accumulator or some of the EMF generated in the primary coil to enhance the magnetisation of a solid rotor. This secondary coil is switched in and out as the rotor turns to prevent it inducing a demagnetising reaction in the primary coil.

Practical switching could be achieved by one of several non-reciprocal connections - a gyrator, a magnetoresistor or a reed relay - but in all cases the switch is accessible for inspection and replacement. The magnetic path is simple and, since no current is supplied to the rotor, the need for brushes, commutators, sliprings or excitation windings is eliminated.



Principle of brushless alternator

The diagram shows a simplified form of such an alternator. The salient pole rotor is not a permanent magnet, but has a small but essential remanent magnetisation. As it turns, an EMF is induced in the primary conductors P; these can be connected to form a single-turn coil to deliver a current via a rectifier (not shown) to charge the accumulator.

The small permanent magnet attached to the rotor shaft actuates a reed relay switch over a few degrees of rotation. When the switch is closed, a burst of current passes from the accumulator via control resistor R to the secondary conductors S. This has the effect of increasing the magnetisation of the rotor.

Since the induced EMF depends on the speed of the rotor, above a certain speed the process will replenish the accumulator. Experiments have shown that such replenishment occurs at practical speeds.

Several magnetic boosts can be produced during each revolution by arranging a number of relays and resistors around the shaft. It would also be possible to build an alternator with several coil pairs and salient poles.

Companies interested in manufacturing brushless alternators using these principles are invited to contact Peter Thompson, Computers, Systems and Electronics Group, National Research Development Corporation, Kingsgate House, 66-74 Victoria Street, London SW1E 6SL, to discuss licensing arrangements.

FOOD AND ALLIED INDUSTRIES

Partially Defatted Edible Cocomut Gratings

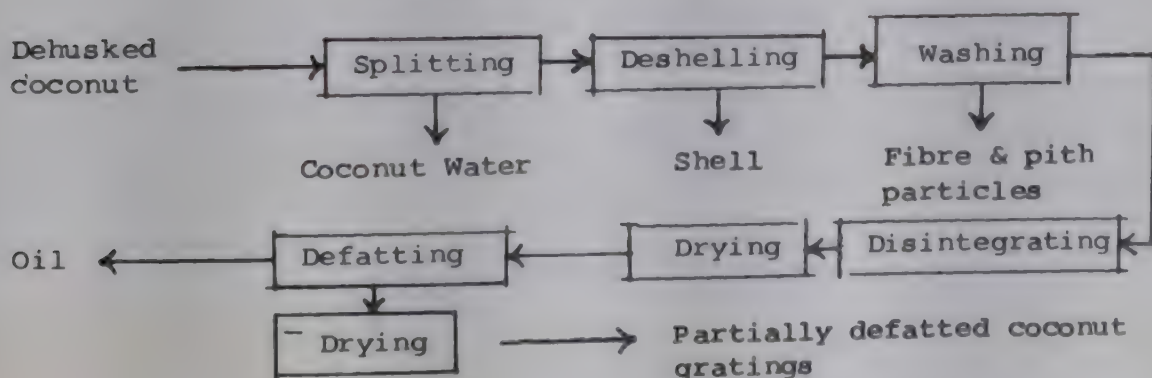
About 2000 tonnes of desiccated cocomut are produced annually which are mainly used in the confectionery market. If a low priced

product is made available, it is likely to find a very good demand for household culinary purpose especially in cities. In view of this, the Regional Research Laboratory, Trivandrum has developed a new process on partially defatted edible coconut gratings, which could be used in many common food preparations like chutneys, curries, sweets and savouries. The special quality coconut oil obtained with a very low acid value and free from rancidity, can be used in cooking and also as hair oil and massage oil, while the coconut shell which is the by-product, can be sold as such. This has a good demand in the preparation of activated carbons, coconut shell charcoal and powder.

Partially defatted coconut is not at present marketed in India. About 300 crore coconuts are at present directly used for food preparations as gratings. If 1% of this amount which comes to 3 crore coconuts, is processed, it would not face any difficulty in finding market. As there is a perennial demand for edible oil in India and coconut oil is in short supply, there will always be a good demand for the oil.

Fully mature coconuts after being separated from the shell are disintegrated, dried and defatted to give white gratings. The partially defatted gratings can be packed in bulk in tins or for retail sales in polyethylene bags.

Block Flow Diagram



Material & energy required per day of production (two shifts)

Matured dehusked coconuts	2000
Electric power	85 KWH
Raw & cooling water	2000 gallons
Fuel (firewood)	650 kg.

The laboratory has carried out work on a scale of 10 kg. per batch. The product was given to a number of people for domestic trials and reports received were very favourable. In laboratory evaluation also, the product was found to be fully acceptable for use in chutneys and curries.

The main raw material is matured dehusked coconuts. These are available indigenously. The main equipment for disintegration, drying, defatting etc. are all available indigenously.

The capacity suggested for a commercial plant is 2000 coconuts per day of two shifts. The capital investment required for a plant of this capacity is Rs.1.15 lakhs for plant and equipment and Rs.80,000 as working capital. The land required is 1350 sq.m. and area of building is 140 sq.m. The cost of production of 167 kg. of partially defatted coconuts, 172 kg. of premium quality oil and 332 kg. of coconut shell per day has been estimated at about Rs.2,865/-.

Refined Cocoa Mass

Refined cocoa mass is a useful flavouring agent for ice-cream, cakes, confections etc. The small scale confectionery manufacturer will find this material highly beneficial for making various items.

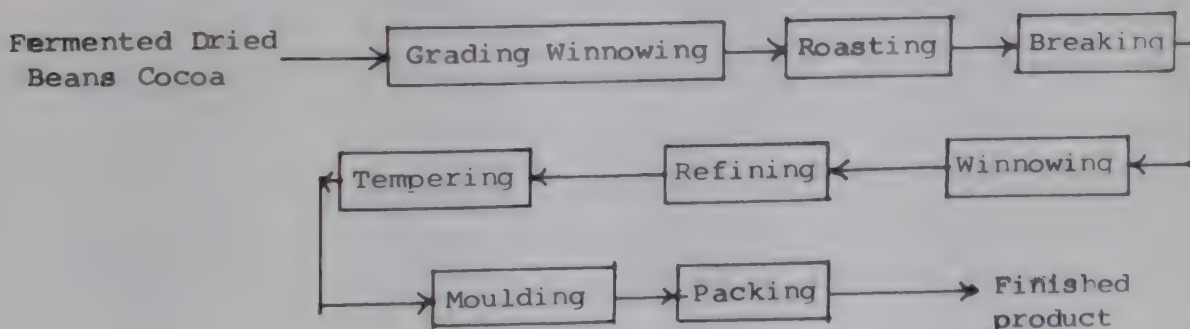
This is a new product in the Indian market and has very good potential. At present cocoa powder, which is more expensive (Rs.120-150 per kg) is being used in the country. Production of cocoa powder requires imported machinery. In India cocoa powder is being produced by five firms mainly from imported cocoa beans. Annually about 2000 tonnes of cocoa beans are being imported from Ghana and Sri Lanka.

It is estimated that there is an immediate demand of 100 to 150 tonnes of cocoa mass per year and the demand is expected to rise to 500-700 tonnes per year in a decade. A preliminary survey in Bangalore has revealed a demand of 3 to 5 tonnes of cocoa mass per month in Bangalore alone.

The cocoa mass produced in the Central Food Technological Research Institute, Mysore has been tried in different preparations like ice-cream, cakes, etc. and found acceptable.

Properly fermented and dried cocoa beans are graded and winnowed to remove light and small beans. The graded beans are roasted under optimum controlled conditions, cooled and shelled. After separation of the shells, the beans are refined in a triple roller mill and conditioned. This refined mass is moulded, packed and stored at low temperature.

Block Flow Diagram



Material and energy required/day of product

Raw material

Utilities

Fermented and dried cocoa beans.....250 kgs Power.....150 KWH

Water.....10,000 lit.

The work in the laboratory has been carried out on a scale of 25 kg. of beans per batch. A total quantity of 100 kg. of cocoa mass has been produced in the laboratory, Limited trials were conducted using commercial equipment outside the institute.

Well fermented, dried cocoa beans of uniform size are to be used for processing. Cocoa is being cultivated on large scale as an intercrop in Kerala and Karnataka. The beans will be available in large quantities in the coming years. The import of cocoa beans therefore, may likely to be restricted.

The main items of equipment are: bean grader, air classifier, roaster, bean breaker, triple roll mill, air conditioner, moulds, tempering kettle, handling and storage vessels etc. All these are indigenously available.

The suggested capacity of a viable unit is 200 kg. of cocoa mass per day (of 8 hrs.) i.e. 50 tonnes of cocoa mass per year (250 days).

Total land required for the unit is estimated at 2500 sq. metres and that for building at 250 sq. meters i.e. 150 sq. meters for shed and 100 sq. meters for office etc. The investment required for the unit having a capacity of 200 kg. of cocoa mass per day is estimated (1979) at Rs.7.0 lakhs (excluding land and building) which includes Rs.2.25 lakhs on plant and machinery and Rs.4.75 lakhs for working capital.

Cost of production comes to Rs.62.80 per kg. based on the cost of base material @ Rs.40 per kg.

Terpeneless Citrus Oils by Chromatographic Method

Terpeneless citrus oils are needed in soft drinks, pharmaceuticals, bakery and perfumery products. Terpenes which are obtained as by-products of the process, are used for the manufacture of flavouring and perfumery compounds. The terpeneless citrus oils are partly imported and partly manufactured in India by some foreign firms whose manufacturing process and the quantity procured are closely guarded secrets. As such no market survey has been conducted. However, there is a good demand for terpeneless citrus oils as our soft drinks, food flavour industries are expanding day by day.

Two jacketed glass columns are filled with silica gel to a certain height and then the citrus oils are loaded on the columns. The residual terpenes on the columns are eluted out by using non-polar solvents. The terpeneless oil portion left on the columns is finally eluted to completion with a polar solvent at a specific rate per column. The terpenes and the terpeneless fractions are recovered by distilling off the solvent. The resulting viscous terpeneless oils tend to deposit waxes on cold storage. Hence waxes can be removed by winterization of citrus oils.

A single person working with a single unit (two columns) can deterpenate 4 to 5 kg. of lime/lemon oil or 8 kg. of orange oil in 8 to 10 hours.

There are no clear cut standards/specifications evolved by any country for the terpeneless citrus oils. However, for raw oil, there are standard specifications. The quality of the end

products depends on the raw oils being used. However, the analysis and evaluation of quality of the commercial as well as CFTRI product shows that CFTRI products are as good as the best samples available in the market.

The work on the process has been carried out at the Central Food Technological Research Institute, Mysore on 4 to 8 kg. oil per unit of 2 columns.

The main raw materials required are silica gel, solvents and citrus oil. While silica gel and the solvents are available indigenously certain variety of citrus oils, not produced in the country, are to be imported. The main items of equipment required are glass columns, flasks, vacuum pumps, water bath, distillation unit etc. All are indigenously available.

Depending upon the availability of raw materials and demand for the terpeneless oils, one or several sets of columns can be used at a time.

A single unit (two columns) is capable of deterpenating 4 kgs. of lemon/lime oil or 8 kgs. of orange oil at a time.

Area of land required for plant, godown, office, lab., workshop etc. is 1500 sq.ft.

The cost of single unit of two columns - Rs.1,500/-

Working capital required - Rs. 30,000/-

Using a single unit to process 4 to 8 kgs. of citrus oil, cost of production is estimated at:

Orange oil	- Rs.1,450/-
Lemon/Lime oil	- Rs. 3,050/-
Yield of terpeneless oil	- 0.35 kg/8 kg. orange oil
	- 0.50 kg/4 kg. lemon oil
	- 0.60 kg/4 kg. lime oil

The cost of production can be brought down considerably by the recovery and reuse of silica gel and solvents.

INSTRUMENTS AND INSTRUMENTATION

Meteorological Instruments

- 1) Wind Direction Recorder; (2) Wind Velocity (speed) Recorder.

These instruments are handy, easy to install and work without any electrical power. Hence these are specially suitable for field use in air pollution surveys, for collecting wind data at the sampling sites.

At present such handy instruments are also being manufactured in India by few entrepreneurs. The estimated average demand for these instruments is 100 units of wind velocity recorders and 100 units of direction recorders per year.

So far about 30 instruments of each type have been fabricated in the National Environmental Engineering Research Institute, Nagpur to meet the various project use of the Institute. The instruments are working satisfactorily.

All the raw materials like Aluminium tubes, rods, angles, brass, hard PVC sheets and cylinders, etc. are indigenously available. The essential plant and machinery required are: (1) Drill press; ii) Lathe; iii) Welding unit; iv) Testing and calibration unit; v) Spray painting equipment; and vi) Assembly unit.

The suggested economic unit for the industry is for 100 units of each instrument per year as detailed below:

i) Fixed capital on building	Rs. 50,000	Common for both	
ii) Fixed capital on plant and machinery	Rs. 55,000		
iii) Cost of raw materials for (100 units each)	Velocity Recorder		Direction Recorder
	55,000		21,500
iv) Depreciation for machinery and building	7,000		7,000
v) Payment of staff	28,500		28,500
	-----		-----
	90,500		57,000
vi) Contingencies @ 10%	9,000		5,700
	-----		-----
	99,500		62,700
Say Rs.	1,00,000		63,000
Profit @ 25%	25,000		15,700
Risk insurance premia @ 10% of 1,00,000 & 62,700	10,000		6,270
	-----		-----
	1,35,000		84,670
	-----		-----
∴ Total cost of production of 100 units each	Rs. 1,35,000/-	Say	85,000
Present selling price per unit: Rs. 1,500/- and Rs. 1,250/-.			

Multi-Test Instrument

For organisations and institutions engaged in R&D activity in the field of electronics, multi-test instrument is an useful device. As its name indicates, the instrument houses several instruments which are commonly used in the laboratory. These include power supply, digital multimeter, frequency counter and function generator. The power supply portion can energise a circuit under test. The function generator serves as an input

to the circuit while the digital multimeter could be used for measuring the voltages at the output or at any intermediate point. The frequency counter can serve to measure the frequency of the input and output signals. For example, the instrument is an ideal one for checking the frequency performance of an amplifier or a filter.

Conventionally separate instruments are used for the different functions e.g. energising the amplifier, feeding the signal, measuring the frequency and measuring the input/output. The advantages of using this single multi-test instrument in place of conventional method are as follows:

1. Power sockets required are reduced.
2. Less table space is occupied.
3. Less cost of the equipments because of common cabinet and common power supplies, while retaining all the features.

It is of great use to educational and R&D institutions, Polytechnics, engineering colleges and to industries, where development and testing facilities are needed at reduced cost and space.

The Central Scientific Instruments Organisation (CSIO), Chandigarh has developed the design for a multi-test instrument incorporating a digital multimeter, a frequency counter, a function generator and DC regulated power supplies. 3 different types of regulated power supplies (+ variable - variable and constant + 5 VDC) are provided in the equipment. It is a compact and low cost instrument. The design is based on LSI technology and uses LED display. CSIO, Chandigarh has made one prototype and the same has been extensively tested for performance and used successfully.

Specifications

A. Digital Multimeter

i) D.C. Voltage

Range	IV 10V, 100V, 1000V
Accuracy	$\pm 0.25\%$ ± 1 digit
Resolution	1 mV on 1 Volt range
Input Impedance	100 M.ohms on basic range

ii) A.C. Voltage

Range	IV, 10V, 100V, 1000V
Accuracy	$\pm 0.5\%$ ± 1 digit
Frequency range	50 HZ to 5 KHz
Usable upto	100 KHz at reduced accuracy.

iii) Resistance

Ranges	1K, 10K, 100K, 1M
Accuracy	$\pm 0.5\%$ ± 1 digit
Resolution	1 ohm on 1 K ohm range

iv) Display

4 digit LED display

v) Overflow indication: A lamp indicates overflow

B. Frequency Counter

i) 1 Hz to 10 MHz in 4 steps

Gate time: 1 sec., 0.1 sec., 10m sec., 1 m sec.

Accuracy: Crystal accuracy ± 1 count

C. Function Generator

i) Range	2 Hz to 200 KHz in 5 ranges
ii) Waveform	Sine, Square and triangle
iii) Output voltage	0 to 5 volts Peak to Peak, open circuit
iv) Output impedance	50 ohms

- v) Sine Distortion Less than 1.5% from 2Hz to 20KHz
 Less than 3.5% from 20 KHz to 200 KHz
- vi) Square wave Rise/Fall time-less than 0.3 micro sec.
- vii) Frequency is directly read digitally in the frequency counter.

D. D.C. Regulated Power Supplies

- i) Voltage & current capacities
 - a. + 4 to + 16 volts, 500 mA
 - b. - 4 to - 16 volts, 500 mA
 - c. Fixed 5 volts, 1 amps.
- ii) Regulation
 - Load 0.25% for load variations from no load to full load.
 - Line 0.25% for change in line voltage from 180 to 250 volts
- iii) Ripple: Less than 5 mV at full load.

The institute has estimated a future demand of 1000 pieces per annum. However, the demand will have to be ascertained before going into regular production.

Facilities for making chassis, painting etc. will be needed for mechanical fabrication. Test equipments required are oscilloscope, frequency counter, precision digital multimeter, LCR bridge, Distortion factor meter, IC tester, transistor tester, avo meters, etc.

Raw materials and components required are: LSI integrated circuits, transistors, diodes, FETs, crystals, resistances, capacitances, potentiometers, connectors, and switches, LED display, transformers, PCB, and other hardware items. The LSI and some of the integrated circuits may have to be imported.

Total fixed capital excluding land and building has been estimated to be Rs.50,000/-. Working capital required for manufacturing 200 units per annum is about Rs.2.5 lakhs.

Terms of know-how transfer

Lumpsum premium	: Rs. 6,000/-
Recurring Royalty	: 2 1/3%
Nature of licence	: Non-exclusive
Period of licence	: 5 years.

Thrust Indicating & Monitoring Equipment

A thrust indicating and monitoring equipment has been developed for measuring loads, structural stresses, earth crest, etc. The system built at a cost of Rs.23,000/- is an expensive piece of equipment to import. The National Aeronautical Laboratory, Bangalore has supplied four such units to the National Fertilizer Corporation for measuring thrust in the bearings of a compressor at their Panipat fertiliser plant.

The system basically consists of load cells, highly stabilised D.C. power supply, tripping circuit, analog panel meter and reference power supply. The system has been designed to accept voltage signals from the loads acting on the compressor and monitor the same using an analog panel meter. The output of the load cell are excited and amplified by a highly stabilised D.C. power supply. The excitation power supplies are short-circuit protected to protect the transistors from any accidental short circuits. These outputs are then fed to the analog panel meter for monitoring. A triggering circuit incorporated in the system facilitates visual alarm and shut downs at 70% and 100% of full scale respectively. When the amplifier output exceeds the value, the comparator gives output which actuates the relays, for either visual alarm or external contact.

All the systems have been tested to evaluate their performance by the Systems Engineering Division. The experimental results obtained hitherto after intensive use of the units in monitoring various parameters have indicated their satisfactory operation.

Specifications:

No. of channels	: 4
Sensing device	: 350 ohms resistance strain guage
Excitation voltage	: 10 V D.C. through bridge balance net work
Speed of response	: 1 sec
Accuracy	: 1.5%
Sitting range	: For visual alarm each channel 0-7% external contact closure 0-80%
Indication	: 0-100 moving coil meter
Meter accuracy	: $\pm 1\%$
Scale graduation	: 100 divisions
Inputs	: Through connector strip provided on the rear panel
Operating ambient temperature	: 10° to 40°C
Power supply	: 110V, 50Hz, A.C.
Dimensions	: 310 x 250 x 450 mm

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New Machinery and Equipment

CHEMICAL PROCESS EQUIPMENT

Fluid Bed Dryer

The fluid bed dryer is for drying granules and allied products particularly in the chemical and pharmaceutical industries. Advantages include speed and uniformity of drying, as well as continuity of production. The wet product passes into the drier directly and the drying process is completed within an average time interval of 20 to 30 minutes. A synchronous motor timer puts off the heaters a few minutes before the completion of the process. Driers with hourly capacity of up to 500 kgs. are available in 4 different sizes. They are manufactured with technical assistance of Werner Glatt of the Federal Republic of Germany. Over 50 such units are already in use in India.

For further information write to: M/s. Alliance Engineering Co. Trisandhya, 97, D. Phalke Road, Dadar, Bombay-400 014.

Spiral Plate Heat Exchangers

L & T have introduced spiral plate heat exchangers for chemical, pharmaceutical and other process industries. The high heat transfer coefficient obtained in L & T spiral plate heat exchanger, coupled with the wrapping arrangement and the self cleaning effect, obtained in a single passage flow, makes the unit efficient and compact. This heat exchanger is ideally suited for handling slurries, viscous, fouling fluids and sterilised

medium. The ease of maintenance makes this unit ideal replacement for SS tubular heat exchanger for all applications up to a pressure of 20 kgs/cm² g.

The spiral heat exchanger is fabricated by coiling two plates, joined and spirally wound, keeping a constant distance between them. Alternate edges of the spiral passage through which the fluid flows are sealed to prevent any intermixing of fluids.

Spiral plate heat exchangers can be fabricated in various materials of construction like carbon steel, stainless steel, brass, aluminium, monel and titanium.

For further information write to: Larsen & Toubro Limited, Chemical Plant Division, L & T House, Bombay-400 038.

ELECTRONICS AND ELECTRICAL EQUIPMENT

// Dew Point Meter

A British firm has introduced a dew-point meter to check the water content of a wide range of products during processing, before packaging, in storage or at retail outlets. The meter provides efficient quality control for foodstuffs, tobacco, pharmaceuticals and cosmetics, seeds and many other goods.

Housed in an alloy cylinder, the unit's 40-mm-diameter x 50-mm-high sensor incorporates an electrically cooled solid gold mirror to detect optically the dew point of the air surrounding a product. This arrangement is claimed to be the most reliable for measuring dew point temperatures, from which the water content of a product can easily be calculated. Sensors can easily be changed, and are unaffected by light and humidity.

The sensor may be used several meters away from the instrument, to which it is connected by cable. Measuring accuracy is maintained by the meter's electronic circuitry even under extreme conditions. Three push-buttons provide for scale readings of dew-point temperatures from 0°C to 40°C, relative humidities and ambient temperatures. Three lamps give at a glance indication of the state of the meter.

Optional modules can be supplied to provide signals for operating control and alarm units.

Weighing under 4 kg. the meter measures 210 mm x 220 mm x 80 mm high. It is supplied in a 330 mm x 240 mm x 100 mm carrying case.

Manufacturers: Protimeter Ltd., Meter House, Fieldhouse Lane, Marlow Buckinghamshire, England.

Digital Electronic Printer PTR 1813

Keltron has pioneered the design and manufacture of India's first Digital Electronic Printer - PTR 1813.

Keltron PTR 1813 conforms to international standards and incorporates the latest techniques in printer technology.

The printing speed of 3 lines per second and capacity of 18 columns make PTR 1813 most suitable for Electronic Calculators, various types of Business Machines and fast Data Loggers.

Keltron PTR 1813 is compatible for use with most LSIs used in printer calculators; and for other applications, Keltron also offers standard Interface Modules.

Application areas of Keltron PTR 1813 include:

- * Electronic Printer Calculators
- * Electronic Cash Registers
- * Instrumentation Systems
- Hard-Copy Output
- * Data-loggers & Computer Systems
- * Automatic Ticket Printing Machines etc.

Specifications:

* Printing Speed	3 lines per second
* Print Cycle time	400 m. sec (approx)
* Column Capacity	Upto 18 columns
* Characters	Upto 13 positions Numerals: 0-9 each 1.5W x 2.4H mm. Standard Symbols: 18 each 1.5W x 2.2H mm.
* Spacing	Column Spacing: 3 mm
*	Line Spacing: 4.5 mm.
* Data Entry	Parallel
* Drive	Brushless DC Motor with Ceramic magnets working on 17V DC $\pm$ 2V
* Power for Motor	Voltage: 17VDC $\pm$ 2V (25°C) Current: 600 mA max. (mean current) at max. printing load
* Physical dimensions	140W x 109L x 71H mm. overall (without paper mounting bracket)
* Mounting dimensions	84W x 53L mm c/c
* Weight	1.2 kg. approx.
* Ribbon	Width - 13 mm.

	Length - 6000 mm.
	Spool - 35 mm. dia
	Colour - Black and Red
	Material - Nylon or vinyl fibre
* Paper	Width: 61 ± 0 mm
	- 1
	Dia: 70 mm. max.

Pen Recorder

A pen recorder introduced by a British firm can measure simultaneously two different parameters in relation to time: for example a.c. volts and temperature, d.c. current and frequency. Parameter changes are effected by removing one plug-in module and inserting another.

The PR2A recorder is supplied with two standard input modules, both covering the range 1mV to 500 V d.c.; alternative modules for d.c. microvolts, single-range d.c. voltages, d.c. current, a.c. volts, frequency and temperature are available.

The chart has a writing width of 255 mm (10 in) and is driven by an electronically controlled pulse motor. It can also be driven by an external signal - sine, square or triangular waveforms - of 5V to 10V peak-to-peak. There are 21 speed settings from 10mm/h giving about two months' continuous operation on one chart, to 600 mm/h. The recorder's twin pens have a fast response - 0.3 second for full-scale deflection - and the recording accuracy is 0.3 per cent of full scale.

A single-pen version, the PRIA, has essentially the same electrical specification.

Manufacturers: Farnell Instruments Ltd., Sandbeck Way,
Wetherby, West Yorkshire, England.

Smoke Detector

PIFCO HONEYWELL smoke detector with dual ionization chamber becomes instantly aware of smoke particles in ionized air and immediately sounds a powerful 85dB alarm.

The ionization detector is sensitive to both visible and invisible smoke particles and is able to detect all the four stages of fire - invisible, smoke, flame, and heat - thereby providing protection to life and property by detecting fire in its early stages.

The smoke detector operates from a 9V MN1604 alkaline battery (supplied) which is easy to replace when necessary - about once a year.

The detector gives an audible bleeping sound for at least 30 days to indicate that the voltage has dropped below a pre-set operational level, and there is a 'press to test' button incorporated which checks the four critical elements - fire sensing chamber, battery, all the circuitry and the alarm - of the detector to ensure its proper operation.

Because it is battery operated, there is no danger of the alarm not working in the event of a power failure or electricity being fused during a fire, and it is easy to instal.

The detector is fitted onto the ceiling or a wall in minutes and comes in a neutral colour to blend with all types of decoration schemes.

A quantity of leaflets is included in each carton of six smoke detectors as well as a fold-out display box with cutout for the supply of leaflets and a sample smoke detector.

The display pack measures 14 in wide x 15 in high x 10 in deep and the smoke detector is firmly secured to the display box to avoid pilferage. The dimensions are $23\frac{1}{8}$ in x $6\frac{3}{4}$ in diam (60 mm x 170 mm).

Details from: Pifco Ltd., Failsworth, Manchester M35 0HS
(061-8321), m U.K.

ENGINEERING EQUIPMENT

Modular Dynamic Test Systems

Electro-hydraulic test equipment of modular design has been developed by a British firm to permit a wide range of testing applications to be met from what are basically three major sections: a load frame or test structure with servo actuator transducers and hydraulic line conditioning; a control console with display/recording facilities; and a hydraulic power pack.

Test procedures possible range from simple assessment of material properties using a discrete monofrequency input through, computer-controlled block programme to highly sophisticated random load testing. Applications include analysing the dynamic properties of elastomers and shock absorbers, studying crack propagation random fatigue, fracture toughness, creep and bending in various materials; simulating service conditions; and general components testing and triaxial testing.

Typical ratings of the modular equipment are: dynamic forces up to 2,000 kN (200 tonforce): strokes of 10 mm to 500 mm; torsional dynamic ratings upto 60,000 nM (6,000 kgf m) velocities from zero to 7.5 m/sec.; and hydraulic working pressures up to 34.5 MPa (356 bar).

During a test the specimen is held securely within the load frame while the hydraulically driven servo actuator subjects it to a pre-determined load, strain or position test sequence. The signal to drive the actuator subjects it to a pre-determined load, strain or position test sequence. The signal to drive the actuator is produced by the system controller which compares the feed back from displacement, strain or force transducers with the command input from a function generator. Typical accuracies claimed for the system are 0.1 per cent for position and 0.1 per cent for force.

Specimen behaviour can be continuously monitored, and the parameters displayed or recorded either permanently or temporarily. The transducer signals can also be used in conjunction with computer control to continuously modify the test programme.

Manufacturers: Keelavite Hydraulic Ltd., Allesely, Coventry Warwickshire, England.

Tool & Cutter Grinder

The tool & cutter grinder is designed to cover a wide range of operations in the shortest possible time, having incorporated in it, the time proven aspects of these machines in addition to some highly practical innovation. Modern production methods and the latest scientific inspections ensure a guaranteed accuracy.

Table: An extra smooth table movement has been achieved by the adoption of 'Antifriction Ball Guide Ways' which not only gives a perfect care of operation, but also results in sustained accuracy of the movement. Quick and accurate taper setting is a unique feature of the machine which eliminates the old 'cut' and 'try' method. Four position controls add to the flexibility of the machine.

Saddle: The saddle slides accurately on a pair of Vee and Flat guideways with enormous bearing area on the pedestal. The cross traverse of the saddle can be obtained both from front and rear by hand wheel.

Grinding Head: The grinding head with built-in reversible two speed motor is adjustable vertically. It can be swivelled through 360° and clamped in any position. The grinding wheel spindle is made of Nickel Chrome case hardening steel, heat treated, accurately finished and ground and runs in a series of specially selected precision type antifriction bearings. The spindle is dynamically balanced to ensure freedom from vibration. The grinding spindle can take grinding wheels at either end.

Electrical Equipment: All switches, fuses are mounted on a totally enclosed chamber in the machine pedestal.

The standard equipment includes:

Work Head: A motorised universal type of work head is supplied with the machine. The head can be swivelled through 360° both on the horizontal and vertical axis. The head is also provided with accurately indexing attachment.

Finger Assembly: Can be fixed on the grinding head or on the table.

Radius dressing device with diamond: Is to be mounted in between two centres for dressing the convex or concave profile of the grinding wheel.

Dressing Block with Diamond:

Plain Grinding Wheel: 8" dia x 1/2" thick x 1 1/4" bore - A 60 K.V.

Taper Cup Wheel: 4" dia x 1 1/2" thick x 1 1/4" bore x 1/4 rim x 1/2 back - A - 46-k-V.

Technical Data

	mm	Inch
Swing over Table	305	12
Length between L.H & R.H. Tail Stock	710	28
Length between Tail Stock and Work Head	560	22
Working surface of Table 915 x	133	36 x 5.25
Longitudinal movement of Table	406	16
Cross movement of table	203	8
Table Swivels	180°	
Table graduation in centre in degrees	1 In. 6(2" per ft).	
Table graduation in centre in degrees	90°	
Vertical movement of Grinding Wheel spindle	190	7.5
Swivel movement of Grinding Wheel Spindle	360°	
Max. distance from centre line of spindle to top of table	285	11.25
Grinding Wheel Speeds	5600 RPM	
	2800 RPM	
Weight of Machine (approx.)	1135 Kg.	2500 Lbs.
Capacity of Motor	1/0.75 H.P.,	2840/1420 RPM, ,

AC 400/440 Volts,
3 Phase, 50 Cycles,

Enquiries to: The General Manager, Machine Tool Prototype Factory,
Ambarnath, Maharashtra.

Vertical Boring and Turning Mill

Cooper Engg. Ltd., Chinchwad have developed a vertical boring and turning mill CVBM-225 which has a displaceable table enabling machining of work pieces varying considerably in diameter

Minimum settling time, due to the centralised, convenient and simple arrangement of the operating controls; change of table speeds by means of thyristor control on pendant; feed changes and directional control of rapid traverse by push buttons on pendant; centralised lubrication and alloy steel hardened and ground main drive gears are some of the outstanding features claimed.

The table is driven by a large diameter helical gear and supported on high precision crossed roller bearing which ensures maximum rigidity and minimum runout.

The machine is equipped with a DC drive main motor having thyristor control allowing the table speed to vary continuously in the ratio 1:100. The column and bottom table are designed to provide max. rigidity under various stress conditions and speeds. The cross rail is guided on the column and locked in position by disc spring. Unlocking is by hydraulic pressure. There is power elevation to the cross rail with automatic kick back arrangement to eliminate backlash. The cross rail head can be swivelled upto 45° on either side.

Each head is actuated by an independent feed and rapid traverse unit. The feed and rapid units incorporate the requisite mechanisms for determining the rate of feed and for selecting the direction of both feed and rapid traverse. The production capacity of the machine can be greatly increased by the use of various accessories. The feed box for the rail head can be equipped with a thread cutting attachment for cutting inch and metric threads. A fine measuring equipment with automatic tripping can be employed to considerable advantage when medium and large size batches are to be handled.

For duplicating complex profiles, a two axis copying attachment can be used. High precision measuring devices for the cross and down feeds of the rail head tool can be provided. The gauges have a measuring range ± 5 mm and are graduated to give readings of 0.01 mm.

Coolant equipment can be provided. The cross rail can be equipped with a ram head, in lieu of turret head. This is especially recommended where deep bores are to be mechanised.

Four way indexing tool holder which can be inserted into the taper bore of the octagonal ram head has four horizontal and four vertical tool positions. These tool holders are especially useful when several tools are required for machining work pieces. The side head can be fitted with a crowning device for producing crowned faces.

A constant cutting speed attachment is useful in facing operation of large diameter jobs. As the tool approaches the centre of the job, the cutting speed increases automatically.

Main specifications: Table diameter 2250 mm
Turning dia (max. 4000 mm
Table speed range
(inf. variable (RPM) 1-100 mm
Table drive (kW) - 60

Industry Roundup

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

Drugs and Pharmaceuticals Industry

Sectoral Contribution Towards Production

Reverting to the production aspect, it is observed that, in this high technology oriented industry, all the three sectors (Public, Indian and Foreign) have been active. The induction of the public sector has given a major thrust to the production within the country of bulk drugs, which had to be imported earlier.

The following table gives the respective shares of the three sectors of the industry:

Table 4

	No. of units	Bulk drug value Rs. in Crores	%	Formu- lations value Rs. in Crores	%
	1	2	3	4	5
<u>1976-77</u>					
Public Sector	2	48	33	47	7
Organised Sector	128	92	60	533	76
S.S. Sector (about	2500	10	7	120	17
		---		---	
		150		700	
Imported bulk		82			

		232			

<u>1977-78</u>					
Public Sector	2	47	29	53	6
Organised Sector	128	105	64	697	77
		12	7	150	
		---		---	
		164		900	
Imported bulk		147			

		311			

It would be seen from the above that while the public sector accounts for a third or the production of bulk drugs, its share of formulations is only 6%. The organised sector accounts for 60-64% of the production of bulk drugs and more than 75% of formulations.

While a marginal contribution by the small scale sector in the field of manufacture of bulk drugs and intermediates required for the drug industry has been assumed as above, reliable and complete data have not been available. The representatives of the small scale sector were of the view that bulk drug production in the small scale sector was considerably more than what is indicated above.

Public Sector

The following table indicates the increase in the value of bulk drug production of the two public sector units - Indian Drugs and Pharmaceuticals Ltd. and Hindustan Antibiotics Limited.

Table 5

Year	IDPL	HAL	Total	Rs./Crores Country's total	%
1974-75	25.72	7.11	32.38	90	36.5
1975-76	35.29	7.41	42.70	130	32.8
1976-77	39.26	9.37	48.63	150	32.4
1977-78	36.24	10.50	46.70	164	28.5

4. Demand/Investment Projections

The demand for the bulk drugs as projected by the Working Group for the different years up to 1982-83 category-wise as also the additional investment needed therefore by 1982-83 would be as follows.

Table 6

Name of the Product Group	1978-79 Demand	1979-80	Rs/Crores 1982-83	Additional investment needed by 1982-83
1	2	3	4	5
1. Antibiotics	115.10	133.50	210.00	152.50
2. Sulphonamides	25.00	28.00	35.00	20.00
3. Vitamins	31.40	36.00	58.00	28.00
4. Anti-dysentery drugs	7.74	8.60	12.00	4.50
5. Anti-diabetic	2.70	3.10	4.80	2.00
6. Anti-T.B.	17.10	21.00	35.00	15.00
7. Anthelmentics	6.00	7.00	11.00	3.00
8. Anti-filarials	0.60	0.70	1.10	0.20
9. Anti-malarials	22.00	23.00	26.90	25.00
10. Analgesics/ Antipynetics/ Antireheumatics/ Antigouts	26.50	29.30	40.30	9.50
11. Anaesthetics	1.60	1.70	2.40	0.50
12. Tranquitzers & Sedatives	5.40	6.10	9.20	3.20
13. Anti-Histamines	1.20	1.40	1.90	0.50
14. Anti-leprotics	0.90	1.00	1.30	0.50
15. Cardiovascular	2.71	3.10	4.80	1.50
16. Diuretics	1.40	1.70	2.70	0.70
17. Anti-Asthmatics	3.60	4.10	6.00	3.20
18. Steroids & Harmones	12.20	14.20	22.60	16.50
19. Anti-Epileptics	1.70	1.90	2.80	2.00

1	2	3	4	5
20. Anti-Nacterials (other than antibiotics & sulphonamides)	4.30	5.10	9.30	5.00
21. CNS stimulants	1.30	1.50	2.20	1.50
22. Anti-cancer	0.15	0.20	0.32	0.50
Total (re- presenting 80% of total requirements)	290.60	332.20	499.62	295.30
Balance of 20%	-	-	125.00	73.80
		(Say)	625.00	370.00

Sectoral Break-up of Investment on Bulk Drugs

The present total value of indigenous production of items now ear-marked for the public sector is about Rs.70 crores. In order to achieve production of the estimated requirements of such items by 1982-83, valued about Rs.237 crores, additional production worth Rs.167 crores has to be organised. The public sector also has plans to produce other important drugs for which it has necessary technology. Keeping all these in view, the break-up of investment up to 1982-83, between the public and private sectors is estimated at Rs.150 crores and Rs.100 crores respectively.

Projections on Formulations

The projected quantum of bulk drugs expected to be available is likely to result in a production of formulations of Rs.1875 crores (1982-83) and Rs.2160 crores (1983-84). The following table gives the approximate distribution of formulation turnover between the

four sectors of this industry during 1976-77. The expected share of formulations between the various sectors during 1982-83 is also indicated therein.

Table 7

	Value Rs. crores 1976-77	% of total	Value Rs. crores 1982-83	% of total	Annual growth rate %
Public Sector	47	6.7	250	13.3	32.1
Indian Sector	241	34.4	700	37.3	19.4
Foreign Sector	292	41.7	575	30.7	11.9
S.S. Sector	120	17.1	350	18.7	19.5
Total:	700		1875		

Role of Public Sector in Formulations

It was pointed out that even the estimate of Rs.250 crores of formulations by the public sector by 1982-83 represents only a share of 13.3% of the total value of formulations and is based on only 35% of the bulk production by the public sector units themselves. As per prescriptions in the New Drug Policy, the public sector is expected to utilise up to 60% of its bulk drug production for its own formulations.

5. Estimates of Imports and Exports

Exports

In respect of a number of bulk drugs, the estimated demand is of a size which may not justify viable investment. In all such cases, a decision based on a case-by-case study has to be taken,

as to whether continued importation of the small quantity of requirements would not be more economical in the national interest rather than the creation of uneconomic indigenous capacity, having special regard to the existing comfortable foreign exchange situation. Make-or-buy' decisions will, therefore, have to be taken on merits of each case, considering factors like the need for a certain very essential drug, desirability of becoming self-sufficient in it, comparative prices of raw materials and intermediates in the international and indigenous markets, availability and potential of indigenous technology, the need to import and absorb crucial technology, etc. The imports of bulk drugs is shown in the table below.

Table 8

Imports of Bulk Drugs

	Rs. in crores		
	1974-75	1975-76	1976-77
1. Antibiotics	8.60	9.31	10.52
2. Anti-malarial	1.63	3.07	7.26
3. Anaesthetics, antipyretics & analgesics	2.22	2.38	2.36
4. Sulphas	2.53	1.90	1.32
5. Hormones & steroids	1.20	1.87	1.54
6. Vitamins	4.14	1.29	1.59
7. Anti T.B.	0.79	0.93	1.49
8. Tranquilisers	0.59	0.89	0.82
9. Anti-diabetics	0.32	0.16	0.01
0. Anti-amoebic	0.22	0.34	0.13
1. Anti-hypertensive	0.28	0.67	1.02
2. Diuretics	0.61	0.63	1.19
3. Drug Intermediates	1.26	1.62	1.71
4. Others	5.30	4.76	5.41
Total:	29.69	29.82	36.37

Exports

India have been showing an increasing trend in export performance of drugs. The basic chemicals, pharmaceuticals and cosmetics export promotion council came into existence in the year 1963-64 when the exports were hardly Rs.2 crores. As against this, the exports during 1976-77 have been of the order of Rs.54.13 crores and the estimated exports during 1977-78 are Rs.55 crores.

Based on the actual exports and the future possibilities, the products covered under drugs and pharmaceuticals exported from India have been grouped as follows:

1. Basic drugs and Fine chemicals
2. Quinine and its derivatives
3. Finished formulations
4. Ayurvedic and Unani medicines
5. Surgical dressings
6. Medicinal Castor Oil.

The following is the break-up in respect of exports of each group in the past three years.

Table 9

	Rs. in lakhs					
	1975-76		1976-77		1977-78	
	contribution in percentage		contribution in percentage		contribution in percentage	
	Value	%	Value	%	Value	%
1. Basic drugs & Fine chemicals	500.7	11.9	570.2	10.5	765.0	14.4
2. Quinine and its derivatives	198.2	4.7	240.4	4.5	121.6	2.3
3. Finished formulations	1643.0	38.9	1712.2	31.6	1672.5	31.5
4. Ayurvedic/Unani medicines	49.6	1.1	98.6	1.8	9.8	0.2
5. Surgical dressings	260.6	6.1	472.6	8.7	546.3	10.3
6. Medicinal castor oil	1574.8	37.3	2319.1	42.9	2186.0	41.3
Total	4226.9		5413.1		5297.2	

Targets for Exports

The Export Promotion Council has envisaged a target of Rs. 62 crores for the year 1978-79. The group felt that it should be possible for the industry to achieve this target. Accepting this figure as the base and providing for an annual growth rate of 12% keeping in view the growth rate for the industry within the country, the following estimates were worked out:

Table 10

	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84
1. Basic drugs	8.0	9.0	10.1	11.4	12.8	13.4
2. Quinine & salts	1.5	1.7	1.9	2.1	2.3	2.6
3. Finished formulations	21.0	23.6	26.5	29.0	33.5	37.5
4. Ayurvedic and Unani medicines	0.5	0.6	0.7	0.8	0.9	1.0
5. Surgical dressings	6.0	6.8	7.6	8.5	9.5	10.6
6. Medicinal castor oil	25.0	28.1	31.6	35.5	39.9	44.9
	62.0	69.8	78.4	88.1	98.9	110.0

6. Research and Development

Research and development in drugs and pharmaceuticals is all the more important in a poor country like India where several communicable and infectious diseases, besides many non-fatal disability ailments and curative medicines are few and their supplies as yet both inadequate and expensive. The emphasis on 'self-reliance' in our successive Five Year Plans also presupposes development of appropriate technology for the manufacture of not only pharmaceuticals, but also the basic chemicals and bulk drugs in the country.

In a hard hitting indictment of the R & D activity of the drugs and pharmaceuticals industry in India, the Committee on Drugs and Pharmaceutical Industry (commonly known as the Hathi Committee) observed: "The present structure of the drug industry being one geared to the market mechanism from which vast majority of the Indian population is excluded, it cannot serve the broad

social goals envisaged." Later in the same vein, the committee remarked, "technology is closely linked up with its social role. In the Indian drug industry, introduction of a new drug or a new process by a unit is decided on the profitability to an individual entrepreneur".

Though one may not agree with all the observations of the Hathi Committee, there is no gain saying that R & D efforts of the drugs and pharmaceutical industry in India are still small. The annual R & D expenditure in both the private and public sectors of the industry is at present around Rs.10 crores, which represents barely 1.5 per cent of the total sales of the industry. Scientists and other supporting staff engaged in R & D number just 2,000. Even a small country like Italy spends annually about Rs.60 crores on R & D in drugs and pharmaceuticals, and engages nearly 5,000 persons on this work. In USA, R & D expenditure on drugs is as high as Rs.1,000 crores a year, employing as many 25,000 scientific personnel. Some of the major American pharmaceutical companies are each spending about Rs.100 crores annually on research and development. Clearly, India has a long way to go in R & D in drugs and pharmaceuticals.

But, in fairness, it should be emphasised that though the level of R & D expenditure of the drugs and pharmaceuticals industry in India is small compared to that in the developed countries, it is actually higher than that of any other industry in the country. It should also not be overlooked that R & D efforts primarily depend upon the volume of turnover and the level of profits. Most of the pharmaceutical companies in India are pigmies by international standards. While quite a few U.S., German and Swiss companies have an annual turnover exceeding Rs.500 crores, even the so-called giant public sector unit in India, the Indian Drugs and Pharmaceutical Limited (IDPL), had a turnover of just Rs.58 crores in 1975-76.

Not surprisingly, with an exception of Ciba-Geigy, Sarabhai, Hoechst, Glaxo and the two public sector units, Hindustan Antibiotics and IDPL, R & D expenditure of most other units is not more than 2 per cent of their sales.

R & D drugs and pharmaceuticals industry includes the following activities.

1. Innovate or basic research for the discovery of new chemical agents and new uses of existing products.
2. Process research and improvement and import substitution.
3. Product development, formulation research and packaging development; and
4. Research on good manufacturing and quality control practices, and development of better control techniques.

(Concluded)

(BS)

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Current Technical Literature

Copies of articles/documents listed in this section are available on payment of Rs.5/- for the first 5 pages or part thereof and Re.1/- for every subsequent page of the photocopy or xerox copy of the article/document. While placing the order, please mention the CTL number of the SENDOC Bulletin.

<u>SUBJECT INDEX</u>	<u>CTL Nos.</u>
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SCIENCE AND TECHNOLOGY

Information Systems

- 370 AIYAGARI V R: UNCSTD: its outcome and relevance to developing countries. Invention Intelligence, 1979, 14(12), 490-498.

Though a modest success, UNCSTD had its bright spots: formation of the inter-governmental Committee on Science and Technology for Development and establishment of the Global Financing System with an Interim Fund of not less than \$250 millions for this purpose for a two-year period (1980-81) were two of its major achievements. There was general agreement that a global information system be set up with appropriate linkages with regional and national information systems.

- 371 CUMBERBIRCH, R J E: Access to world literature via On-line systems. The Textile Institute and Industry, 1979, 17(11), 406-409.

Explains how computer-based information services and the networks by means of which they are (or will be) linked can offer a whole new range of facilities to the service users. (BS)

- 372 MACALUSO PAT: Through technology with pad and pencil. Chemtech, 1979, (Aug), 466-469.

Can an individual pressed by management for new ideas, sit down with nothing more than a pad and pencil and come up with something-just like that? Is it possible to spend just a few hours in the library or in the files or in conversation and produce not just one, but several useful proposals? This articles purpose is to show that it can be done, simply and immediately...and how.

PAPER, PULP AND ITS PRODUCTS

- 373 -----: New process developed to produce pulp. Kisan World, 1979, 6(10), 33-35.

Highlights pulp making and recycling of waste materials for pulp industry in sugarcane producing developing countries. (MKSS)

- 374 FARNSWORTH D: Paper by hand. Rural Technology Bulletin, 1980, (4), 8,10,12,14.

The setting up of a handmade paper industry on a small scale is explained in detail with a flow chart of the process. (JBS)

375. ATTWOOD B W & WHITE D G: A dry-forming process for multi-ply board. Tappi, 1979, 62(2), 39-41.

The use of a dry process for producing multi-ply paper board grades is described. Details are given of experimental apparatus, pilot plant equipment, and a prototype machine used for producing trial sheets of multi-ply structures. Possible application of a dry process to the manufacture of various multi-ply structure is discussed, including not only completely dry-formed structures, but also those where wet-formed webs are combined with dry-formed webs.

376. JAHN E C: Cellulose for the world's expanding need for fibres. Tappi, 1979, 62(2), 31-35.

The present status of the paper and cellulose industries is reviewed in terms of competition with and substitution by other materials. Research and technological development in processing, fibre qualities, and products are

reviewed. Research needs for future development are identified.

OILS AND FATS

- 377 Physical refining - a new trend in the edible oils and fats industry. Food Processing Industry, 1979, 48(569), 33, 38-39.

Highlights a new trend in the edible oils and fats industry. Discusses the advantages of physical refining over the alkali process. Examines the suitability of steam distillation. (MKSS)

- 378 ACHAYA K T & CHAKRABARTY M M: Chemicals based on castor oil and other oils - A Seminar. Journal of Scientific and Industrial Research, 1980, 39(2), 69-72.

A seminar organised by the Ganesh Scientific and Research Foundation, New Delhi on August 17, 1979 discussed the development of castor oil based chemicals and oleochemicals. Considering that the major outlets for oleochemicals lie in industries like textiles, paper, surface coatings, plastics and lubricants, which are well established in India, the future for their production appears full of promise.

- 379 LAHIRI C R and CHAUDHURI K K: Oxidation of paraffin wax to fatty acids - A review. Indian Chemical Journal, 1979, 13(8), 18-25.

Reviews the most recent developments up to 1977 on the oxidation process, its kinetics and thermodynamics, the catalysts, arrangements of apparatus, dependence of the oxidised products on composition and properties

of the raw materials and analysis of the products. (BS)

380. RAMARAO G et al: Wet rendering of coconuts for oil extraction and utilisation of by products. Indian Coconut Journal, 1979, 9(11), 4-6.

FOOD AND ALLIED INDUSTRIES

Confectionery

- 381 -----: The manufacture of confectionery. Indian Sugar, 1980, 29(10), 639-664.

Principles, recipes and processes are reported for the manufacture of snow balls toffees, barley sugar, humbugs, bull's eyes, mintoes, lozenges, peanut brittle and naugat montelimar. (MKSS)

- 382 CHRISTOPHER V: Wedding cakes; basically the same but how they can vary. British Baker, 1979, 176(37), vi & x.

Presents detailed information to prepare various cakes, particularly wedding cakes.

- 383 MINIFIE B: A review of the processes for the manufacture of milk chocolate. The Manufacturing Confectioner, 1979, 59(10), 43-45, 47-48.

Beverages

- 384 -----: Keeping water pure for maltese soft drinks production. Food Processing industry, 1979, 48(572), 43-44.

The operation of the water treatment plant for soft drink is discussed. (MKSS)

- 385 -----: Soft drinks - An overall view. International Flavours and Food Additives, 1979, 19(2), 67-68.

Gives a review of the soft drinks industry, including recent changes and current and future trends. (MKSS)

- 386 POTTER R: The brimstone process of desulphiting stored grape juice. Food Technology in Australia, 1979, 31(3), 113-115.

A modern winemaking technique is described whereby clarified grape juice is preserved with high levels of sulphur dioxide (1200-200 mgpl) and then desulphited just before fermentation. The advantages of such a process compared to conventional wine-making technology include reduced refrigeration demand, greater total yield and flexibility, and the production of fresh fruit flavoured wines. Considerable care is still required during the period that the juice is stored prior to desulphiting to ensure that fermentation does not occur; otherwise wine will be produced with an excessively high level of sulphur dioxide (AA)

DYES

- 387 -----: An analysis of India's exports of dyestuff. Industrial Researcher, 1979, 6(2), 125-130.

Examines the problems faced by the exporters and explores the potential market where further exports could be achieved.

- 388 -----: Dyestuffs industry - industrial policy and future developmental plans with special reference to exports. Colourage, 1979, 26(7), 41-45.
- Gives statistics regarding number of units in production, installed capacity, production, export from 1971 to 1976 and itemwise export for the years 1975, 1976 and 1977. (SSD)
- 389 -----: Industry profile - Dyestuffs industry. Industrial News Digest, 1979, 2(2), 1-5.
- Traces the growth of the industry, its production capacity, consumption pattern, exports and imports, the technological skill available, production in the small scale sector and future prospects for the industry. (JBS)
- 390 GEORGE M: High fixation reactive dyes-A review. Man-made Textiles in India, 1980, 23(1); 15&17.
- Reviews the mechanism of high fixation reactive dyes. (BS)
- 391 KHATIWALA H C: When the flower of the chemical industry blossoms forth. Colour & Chemicals Weekly, 1979, 5(3), 22-24.
- Surveys the dyestuffs industry's present status and suggests some measures to improve the situation. (MSR)
- 392 MEHTA M B: Scope for establishment of dyestuff industry in South India. Chemical Weekly, 1980, 25(23), 73-75.
- Reviews the dyestuff industry in general in India and examines the market potential, technology, raw materials, present state and future scope of dyestuffs in South India. (BS)

- 393 MACHANE, S D & DASGUPTA A: Procilene PC liquid dyes: role in textile industry. The Chemical Times, 1980, 7(13), 8.
- 394 NARKAR A K : Reactive dyes: Some developments in printing. Textile Dyer & Printer, 1979, 13(2), 32-35.

Reviews the developments in modifications of reactive dyes with reference to high reactivity, high fixation and new dyes to fill up gaps in the available range of shades, modification in application techniques to achieve higher fixation and lower residual hydrolysed dye and modification of cotton physically and chemically to suit different requirements of reactive dye fixation. (BS)

ESSENTIAL OILS, PERFUMES AND COSMETICS

395. -----: Lanolin anhydrous - A feasibility study. Industrial Researcher, 1979, 6(3), 197-202.

Lanolin anhydrous is a purified fat-like substance obtained from wool of sheep and is widely used in pharmaceutical industry and in cosmetics. The cost of a 50 tonnes/year capacity project is estimated to be of the order of Rs.10 lakhs.(JBS)

- 396 BANDELON F J: Alcohol in hair & scalp preparations. Soaps, Detergents & Toiletries Review, 1979, 9(4), 29-32.

Depending on its requirement as a solvent, penetrant, drying, preservative or a combination of these, alcohol can confer utility and elegance upon a number of hair care products such as brilliantines, alcoholic hair

lotions, sprays and lacquers setting lotions, two layer lotions, and gum base hair dressings. The formulation of these hair care products are reviewed.
(KSDR)

- 397 BATHE P: Cosmetic and perfumery raw materials survey. Manufacturing Chemist and Aerosol News, 1979, 50(5), 37-38, 41-42, 45.

An annual survey of recently introduced ingredients for cosmetic, toiletry and perfumery products.

- 398 CALOGERO A V: Branched chain esters and their applications in haircare products. Soaps, Detergents and Toiletries Review, 1979, 9(7), 17-19.

Gives some prototype formulations giving evidence to the utility and compatibility of the branched chain esters in hair care products.(KSDR)

- 399 GRIZZO S: Colour 1: Carmine and its uses in cosmetic applications. Soap Perfumery and Cosmetics, 1979, 52(5), 233-235.

- 400 MCCARTHY J P & LARYEA J M: Effects of the use of lanolin acid quaternary in hair conditioning preparations. Soaps, Detergents and Toiletries Review, 1979, 9(7), 15-16.

Gives some starting formulations which demonstrate the use of lanolin acid quaternaries in hair conditioners.

SURFACE COATINGS

- 401 -----: Paints and coatings. Industrial Maintenance and Plant Operation, 1979, 40(5), 55-56.

Painting and coating maintenance programmes can be expensive and time consuming, but provide necessary protection from both indoor physical abuse and outdoor corrosion of plants, factories and warehouses. Explains the types of paints and coatings, primers and coatings, primers and describes their preparation and speciality products made with a special purpose.(SS)

- 402 BHANDARI P K: Development trends in paint industry. Colour and Chemicals Weekly, 1979, 4(44), 35-36.

An overview of the paint industry is presented.(MSR)

- 403 BHUMKAR C J: Technical aspects of modernisation of small paint units. The Chemical Times, 1979, 6(3), VI-VII.

Reviews various factors like equipment layout, formulations quality control, etc. to be considered for modernisation of small scale paint unit and discusses the management of such a modernisation with particular reference to paint technology in Indian environment. Emphasises the need for an integrated approach for a successful mechanisation.(MSR).

- 404 MANI T K S: Scope for development of paint industry in South India. Chemical Weekly, 1980, 25(21), 75-80.

Examines the scope for development of paint industry in South in terms of availability of raw materials, skilled personnel and other facilities.(BS)

PLASTICS

- 405 -----: High density polyethylene monofilament yarn - A feasibility study. Industrial Researcher, 1979, 6(2), 139-148.

The total project cost for establishing an economically viable 180 tonnes/yarn capacity plant is Rs.10 lakhs. The financial position of the project is considered in detail.(JBS)

- 406 BHATTACHARYYA K K: Glass fibre reinforced plastics: Information sources. Transactions of the Indian Ceramic Society, 1979, 38(5), 200-204.

- 407 BIHANI S N: The problems SSI units face in exporting plastic products. Colour & Chemicals Weekly, 1979, 5(8), 29, 31, 33, 34.

The main reasons for encouraging the small scale sector units in plastics industry, production, exports, duty drawback and list of plastic items reserved for small scale sector are discussed.(SSD)

- 408 KHARBANDA O P: ABS resins. Chemical Weekly, 1979, 24(23), 2-5.

Typical process, producers with capacities, future and techno-economic details for a project manufacturing ABS resins are given.(MSR)

- 409 SRIKANTA AIYAR A H: Indian plastic industry: Today and tomorrow. Popular Plastics & Rubber, 1979, 24(10), 34-40.

Gives the consumption pattern of plastics, raw materials, installed capacity and the production of raw materials

during 1976, 1977 and 1978, imports and exports of plastics raw materials and their projected demand, the existing and planned capacities and anticipated production of plastics. (KSDR)

LEATHER INDUSTRY

- 410 -----: Full chrome upper leather. Journal of the Indian Leather Technologists' Association, 1979, 27(4), 13-17.

Enumerates the characteristics of full chrome upper leather, gives the range and description of leather auxiliary products and a variety of speciality chemicals for use in the production of shoe uppers. Presents formulations for full chrome cow upper from wet blue cow hides and full chrome glacekid from wet blue goat skins. (BS)

411. BELL T: Polyurethane and its use in the footwear industry. Indian Footwear, 1979, 3(4), 8-10.

Highlights the unique characteristics of urethane for specific markets of footwear industry. (BS)

- 412 LAKSHMINARAYANAN N: Footwear consumption pattern in India. Leather Processing, 1979, 2(9), 20-22.

Gives statistics of footwear consumption in relation to human population, categorywise, statewide and statewide per capita consumption for the year 1969-70. (BS)

- 413 LORANT I & RADNOTI L: Fibre-board products in shoe manufacturing. Leather, 1979, 181(4448), 49-51.

Discusses the physico-mechanical properties of the insole materials based on leather fibres, insole

materials based on alphacellulose fibres and insole materials based on leather fibres and alpha cellulose fibres.(BS)

MECHANICAL ENGINEERING

- 414 -----: Cold roll formers are fast on bends. Machinery and Production Engineering, 1979, 134(3445), 25-28.

Deals with cold roll forming (CRF) techniques to form an advanced louvre profile, claimed to be a considerable improvement over conventional Z sections.(KLR)

- 415 -----: Commercial vehicles - a review. Industrial Resear- cher, 1979, 5(4), 201-206.

Presents an overall analysis of the industry in India.

- 416 -----: Creep feed grinding is shaping up fast. Machinery and Production Engineering, 1979, 134(3467), 25-27.

Describes how creep feed for small batch production of press tool parts has shown impressive results.(KLR)

- 417 -----: Pump selection made easy. Industrial Maintenance and Plant Operation, 1979, 40(1), 71-72.

Gives the classification and functions of pumps and the points to be taken into account while selecting pumps.(SS)

- 418 -----: Wide wheel buffing of automobile bumpers. Product Finishing, 1979, 32(1), 27.

Explains the new method of buffing of wide wheel automobile bumpers.(SS)

- 419 BAILEY R L: **Magnetic liquid seals.** Chartered Mechanical Engineer, 1979, 26(2), 49-52.

Ideas for a magnetic liquid seal were current when engineers were first working with magnetic liquid clutches. A liquid was constructed which would become highly viscous when placed in a magnetic field. If placed between a driver disc and an idler disc, the liquid could solidly connect the two on application of an electro-magnetic field. When the field was relaxed, the discs could slip relative to one another. Later, it was observed that rings of the liquid could be used to fill the relative motion gaps between static and mobile components, thus blocking the relative motion gap path to leakage flows and providing a magnetic liquid seal.

- 420 CHATURVEDI R C & BAPAT P D: **Optimisation in rolling.** Machine Building Industry, 1979, 18(8), 21-25.

Introduces the concept of optimisation, outlines the general approach and then discusses the parameters, interrelations, and performance indices with specific reference to rolling. A classification of the types of optimisation problems in rolling from the point of view of user is attempted and general outline of the methods of solutions are given. Finally it deals with the specific case of the problem of rolling in a single stand cold rolling mill. The process details are briefly outlined, and the flow diagram for a computer programme developed for this process is presented. The usefulness and limitations of the programme are discussed and suggestions for future work are outlined.

METALLURGICAL INDUSTRIES

- 421 -----: Explosion welding. Machine Building Industry, 1979, 18(8), 33-35.

Explosion welding is basically a solid-state process and yields an autogenous and diffusionless weld. Discusses the process theory, explosives used, advantages and applications of explosion welding. (CS)

- 422 GANAPATHY V: Welding engineer data sheet. Welding Design & Fabrication, 1979, 52(6), 97.

Presents a nomograph for calculating the thickness of pipe walls. An example is given to show how it can be used to determine the wall thickness directly. (CS)

- 423 LUNN M G: Precision substitute for the craftsman's hammer. Welding and Metal Fabrication, 1979, 47(5), 291-293, 296, 297.

Shot peening has replaced the hammer in many applications where work hardening and prestressing are required. Discusses the shot peening process, its advantages and applications.

- 424 SANDERSON L: Brazing and soldering progress. Chartered Mechanical engineer, 1979, 26(7), 53-55.

No sensational development have been announced over the past two or three years in the joining of metals by soldering and brazing. Nevertheless some advances have been made, and these are summarised.

- 425 VISVANATH P S: Continuous flux-cored wires for arc welding. Industrial Welder, 1979, 9(1), 15-18.

The advantages of the flux cored arc welding process

are discussed. The functions of the flux which forms ingredients of the core are given. The action of the external gas shielding CO_2 on flux cored wires is presented. The manufacture and economics of flux cored wire are also covered. (CS)

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SENDOC Services

Featured in this section are technical enquiries that were received and the services rendered by SENDOC during the month of July 1980. The charges for short technical enquiries will be Rs.5.00 to Rs.10.00 per typed page. Industry profiles already available with SENDOC are charged at the rate of Rs.10.00 each.

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1.	DIC, Dhenkanal, Orissa	Profiles on: Gauge and bandage, Polyethylene cloth/paper, Polyethylene bags, Polyethylene packing materials, Polyethylene tubings, Cashew nut processing, Palm rose oil.
2.	Ent. Andhra Pradesh	Profiles on: Steel wire drawing, Camphor, Batteries, Roofing tiles, Ferro ammonia paper, Flush doors, Plastic buttons, Safety matches, Agarbathis.
3.	Ent. Bihar	Profile on: Bolts and nuts.
4.	Ent. Goa	Profile on: Saponin from soap nuts.
5.	Ent. Karnataka	Profiles on: Precipitated calcium carbonate, pulp mill
6.	Ent. Madhya Pradesh	Profiles on: PVC Cables, Biscuit industry.
7.	Ent. Maharashtra	Profiles on: Cardboards, Aluminium hardwares, Bleaching powder, Bolts and nuts, Aluminium metal tubes.
8.	Ent. Orissa	Profiles on: Stoneware pipes, Steel rerolling mill, Printed tin containers.

Sl.No.	Enquirer	Service Rendered
9.	Ent. Tamil Nadu	Profiles on: Biscuit industry, Television components.
10.	Ent. Uttar Pradesh	Profile on: Wooden Bobbins.
11.	FI. West Bengal	Profile on: Reclaiming of engine oil.
12.	GD. Andhra Pradesh	Profile on: China clay washery.
13.	GD. Tamil Nadu	Profile on: Copper salts.
14.	IC. Bihar	Industry roundups on: Foundry industry in Bihar, Drugs and Pharmaceuticals industry in Bihar.
15.	IC. Maharashtra	Profiles on: Straw board, Hosiery, Textile woven labels, Tamarind powder, Pectin from papaya.
16.	IC. Nepal	Technical note on: Caustic soda.
17.	MI. Maharashtra	Profiles on: Cardboards, paper mill.
18.	SI. Andhra Pradesh	Profiles on: Laboratory chemicals, Tapioca, Distilled water, Glucose solution, Match industry, Welding electrodes, Pilferproof caps, Polyethylene bags, Emery grits, Plastic cane, Bread and biscuit unit, Detergent powder, Sodium silicate, Steel rolling mill, Plastic containers.
19.	SI. Bihar	Profiles on: Leather tanning, Glue, Phenyle, Boot polish, Pharmaceuticals unit.
20.	SI. Madhya Pradesh	Profile on: Air coolers.
21.	SI. Maharashtra	Profiles on: Papads, Cardboards, Soda ash, Plywood industry, Distilled water, Bolts and nuts, Graphite crucibles, GI drums, White cement, Stainless steel utensils.

Sl.No.	Enquirer	Service Rendered
22.	SI. Orissa	Profiles on: Stainless steel utensils, Carbon brushes, Carbon blocks, Ferric alum, Decorative laminates.
23.	SI. Rajasthan	Profiles on: Straw board, Tooth powder.
24.	SI. Tamil Nadu	Profile on: Mini rice mill.
25.	SI. Uttar Pradesh	Profiles on: Speciality papers, Paper mill, Beta naphtol.
26.	SI. West Bengal	Profile on: Leather tanning.

Note: DIC - District Industries Centre, Ent. - Entrepreneur,
 FI - Financial Institution, GD - Government Department,
 IC - Industrial Consultant, MI - Medium Industry,
 SI - Small Industry.

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New Products and Processes

AGRO BASED INDUSTRIES

Active Carbon from Coconut Shell

Active carbon, obtained from coconut shell, is of gas adsorbent grade and is used in fertiliser and rayon industry for recovery of solvents and in gas masks for gas absorption. At present good quality gas adsorbent carbon is not being made in the country and the requirements are being met by imports. The coconut shell is abundantly available in our country.

Coconut shell is crushed in a hammer mill to the required size and then pulverised in a ball mill. The shell powder is digested with zinc chloride and hydrochloric acid. The mass is pelletized and dried. The pellets are activated at elevated temperature and then quenched and leached countercurrently by dilute hydrochloric acid and dried in a tray drier.

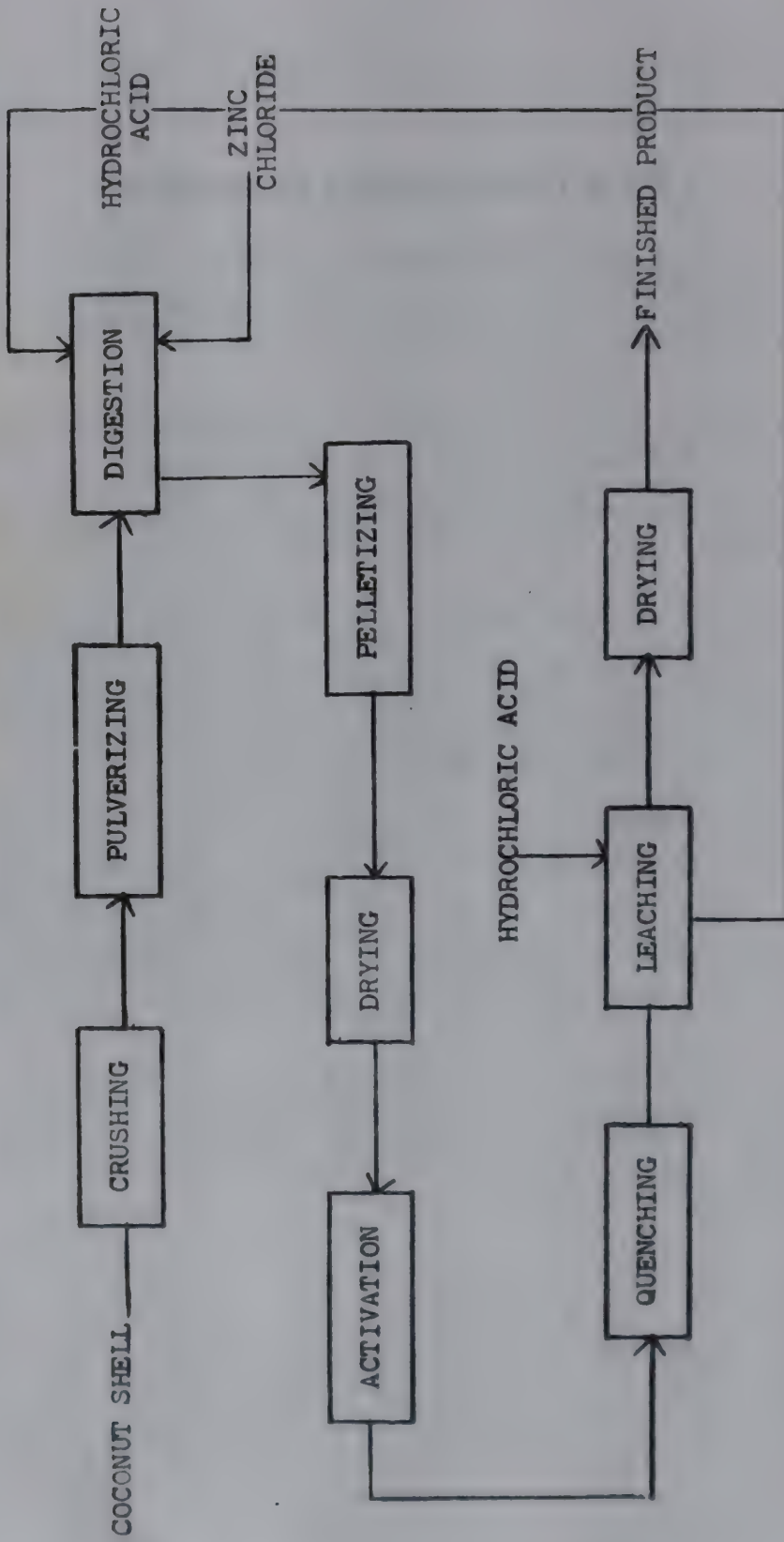
The process developed by the Regional Research Laboratory, Hyderabad has been tried out on a pilot plant of 100 Kg/day capacity of coconut shell. The raw materials required are coconut shell, zinc chloride, hydrochloric acid and binder, all indigenously available. The main items of equipment - hammer mill, ball mill, storage bunkers, digestion vessel, activation unit, filter, tray dryer, mixer, pelletizer, boiler, leaching tanks - are indigenously available.

For a plant of one tonne (active carbon)/day (3 shifts) capacity the total capital investment is estimated at Rs 2 million (excluding land and building). About 60 persons are required for operating the plant. It has been licensed to one party who has commenced trial production.

Colchicine from *Gloriosa Superba*

India being richly endowed with herbs and medicinal plants, there is a vast scope for production and use of phytochemicals in this country. Colchicine is a phytochemical that can be manufactured from *Gloriosa superba*, which grows in several parts of the country, especially in south India. Colchicine is used in the treatment of gout and in the biological practice of polypoidy in pharmaceutical industry. This important drug has a good export potential. The demand for colchicine in the country is at present being met by imports.

BLOCK FLOW DIAGRAM FOR ACTIVE CARBON FROM COCONUT SHELL



The corns of *Gloriosa superba* are crushed and the powder is extracted with water. The aqueous extract is repeatedly partitioned with a water-immiscible solvent. The soluble alkaloids are then concentrated by distilling off the solvent and recovering it for re-use. Purification and separation of the alkaloids is effected in a chromatographic column, and colchicine obtained is further purified by crystallization. The other related alkaloids like N-formyl-desacetyl colchicine and dimethyl-colchicine are obtained as by-products.

The process developed by the Regional Research Laboratory, Jammu was investigated on a scale of 40 Kg. of *Gloriosa superba* per batch. About 1 Kg. of colchicine was produced and tested. The product was found to conform to international standards.

The major raw materials for the process are dry corns of *Gloriosa superba*, and some chemicals, which are indigenously available. The main items of equipment are grinding mill, stainless steel extraction vessels with stirrers, false bottom stainless steel mixing vessels with stirrers, filter press, and mild steel distillation stills. All these can be indigenously procured.

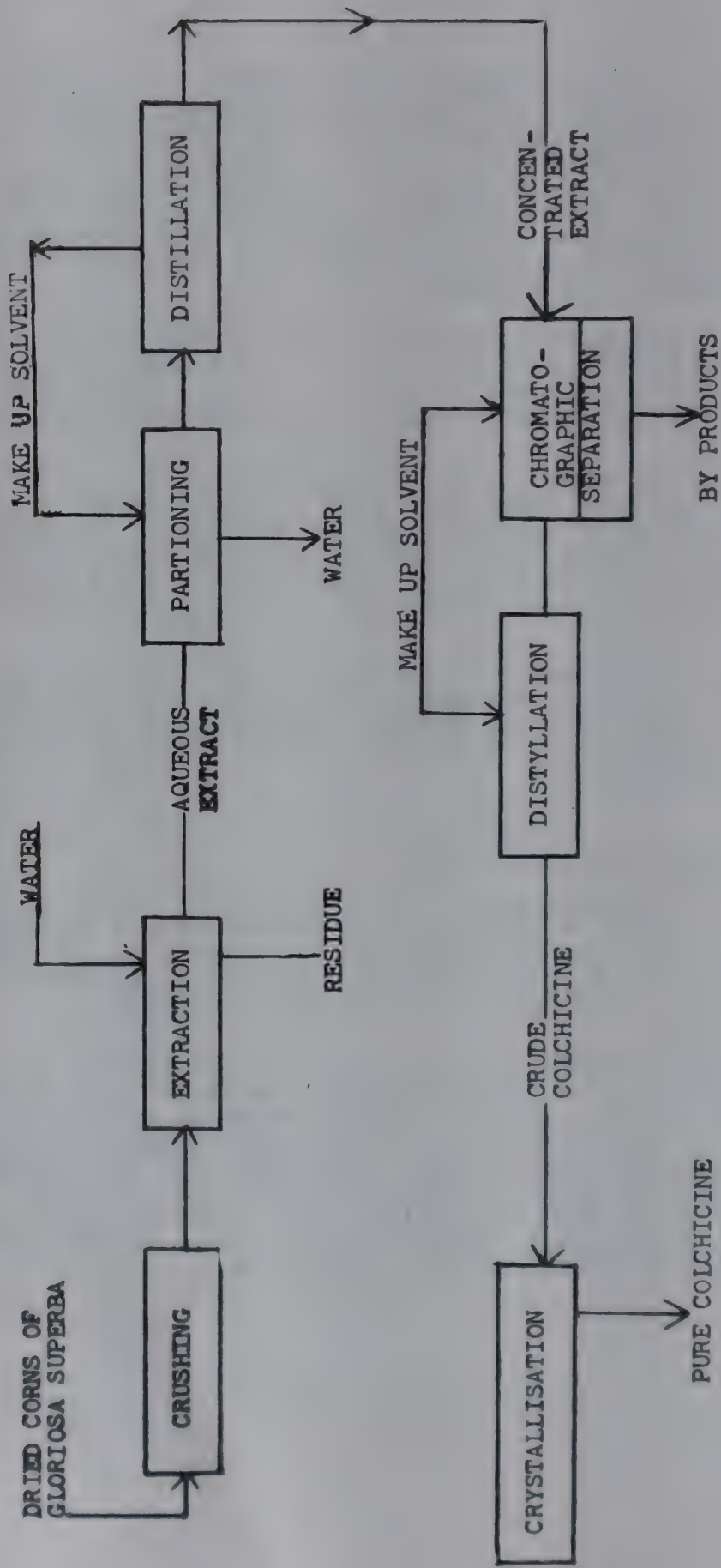
A plant with an annual capacity to process half a tonne of *Gloriosa superba* is estimated to need an investment of Rs 1.2 million. The plant may provide employment to about 10 persons. The process has been licensed to two parties, and one of them is in production.

Paper from Agricultural Wastes

With the increasing demand for all types of paper, it has become necessary to explore and use new sources of raw materials, that are cheap and abundant, like mesta, bagasse, jute sticks and straw from wheat and paddy. The utilisation of these agricultural wastes is becoming increasingly important.

The conventional methods for production of paper from these materials have low yields (40-45%) and do not make an attractive venture. A completely new process known as the 'hot caustic soda process' has been developed by the Forest Research Institute, Dehradun. The yield of pulp is 60-65%. The consumption of chemicals like caustic soda being substantially lower, highly economic production is possible even in small plants. The pulp made by this process can be used in the manufacture of newsprint, wrapping paper, writing and printing paper.

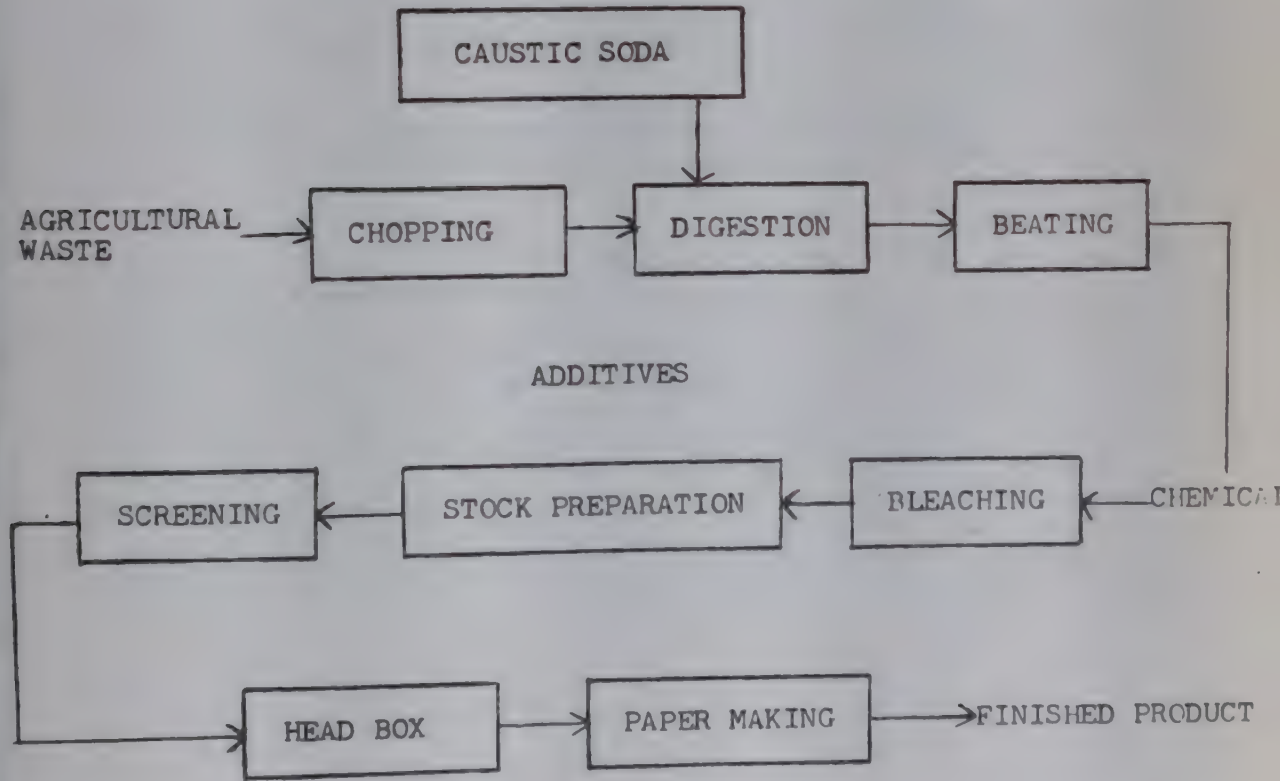
BLOCK FLOW DIAGRAM FOR COLCHICINE FROM GLORIOSA SUPERBA



The new process employs a quick, simple, practical and economical method of obtaining high yield pulp. It involves two stages: in the first stage, the raw materials in the form of chips are cooked with caustic soda solution for a short period. The quantity of caustic soda is varied depending upon the raw materials used and the grade of pulp desired. After caustic treatment, the spent liquor is withdrawn and the treated chips are washed with water. In the second stage, the treated chips are mechanically converted into pulp. The refined pulp is then washed with water, screened, bleached, beaten and converted into paper on conventional paper making machine.

The process has been carried out on a pilot plant of 6 tonne/day capacity. Agricultural wastes, caustic soda, chlorine, sodium sulphate, rosin and fillers are the main raw materials required in the process, all of which are available in the country. The major items of equipment required include chopper digester, beaters, bleaching tanks, mixing tanks, wire screen paper machine, all are available in the country. Investment on a plant of 10 tonnes/day capacity is estimated at Rs 15 million. About 150 persons are needed to operate a plant of above capacity. The process has not been licensed so far.

BLOCK FLOW DIAGRAM FOR PAPER FROM AGRICULTURAL WASTES



ELECTRONICS AND ELECTRICAL INDUSTRIES

Ferrite-Clad Aerials

Professor JR James and Dr. A Henderson of the Electronics Department, Royal Military College of Science have discovered that a thin cladding of ferrite materials can be as effective as a thicker cladding of pure dielectric material in reducing the height of high-frequency (HF) whip aerials and offers the additional advantage of increased input impedance.

Portable or vehicle-mounted radio sets operating in HF and VHF bands often use quarter-wave monopole whip aerials that can be awkward to handle owing to their length, particularly in the HF band. One solution to the problem is to reduce the length of the aerial for a given frequency by cladding the conductor with a dielectric material. Unfortunately the thickness of dielectric cladding required to achieve a given proportional reduction in length increases with decreasing frequency until, below 100 MHz, the cladding becomes impractically bulky.

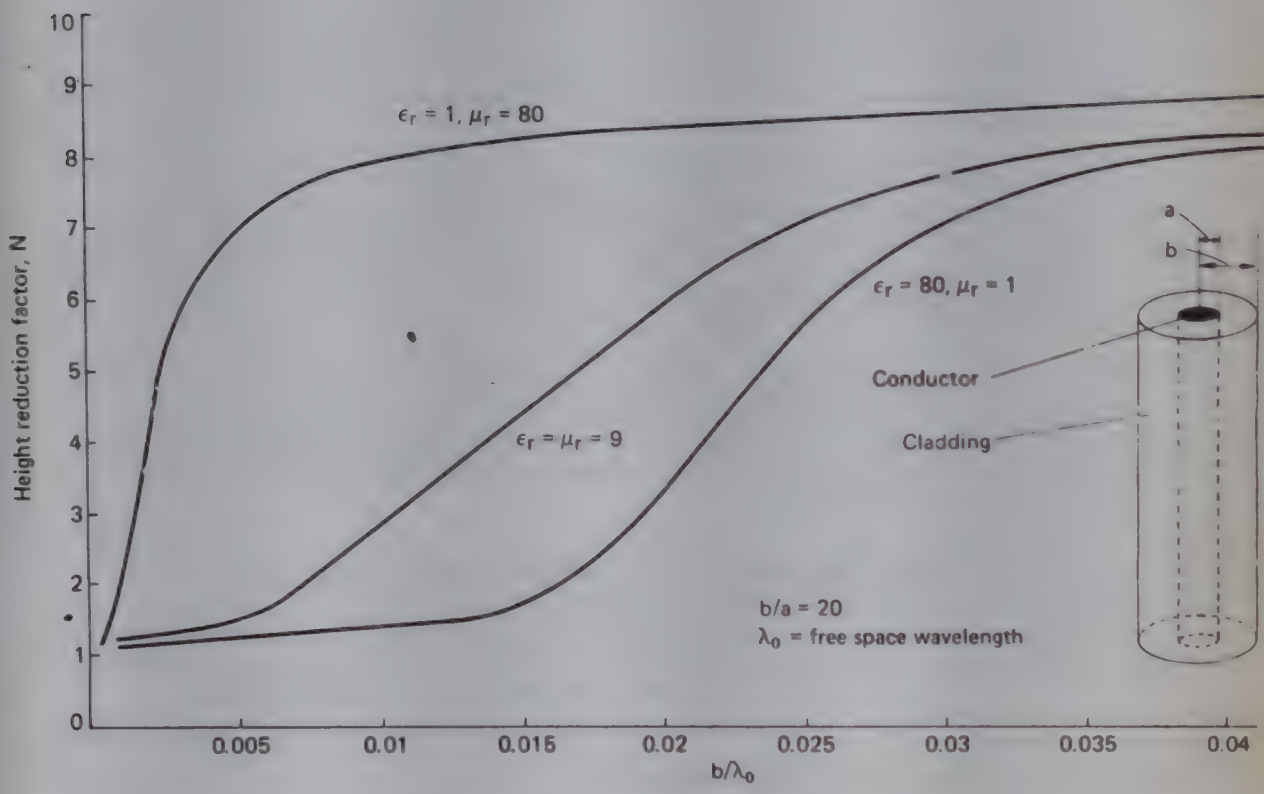
A similar reduction of physical length while retaining the required electrical length' can be achieved by using a cladding of ferrite, with the important advantage that much thinner claddings of ferrite are required compared with pure dielectrics to produce a desired reduction in length. A more compact aerial can thus be built.

The best height reduction factor N that is theoretically achievable is given by:

$$N = \frac{\text{Electrical length of clad conductor}}{\text{Electrical length unclad conductor in free space}} = \sqrt{\epsilon_r \mu_r}$$

Where ϵ_r is the relative permittivity and μ_r is the relative permeability of the cladding material. In practice, however, it has been found that, as the thickness of the cladding decreases in relation to the freespace wavelength, N becomes highly dependent on the relative values of ϵ_r and μ_r that make the constant product $\epsilon_r \mu_r$. The family of curves shown in the graph indicates the general effect for an antenna with a cladding thickness ten times the diameter of the central conductor. The 'knee' in the curve of N against b/λ_0 is most pronounced for materials in which $\mu_r \gg \epsilon_r$. It can also be shown that the greatest height reduction factor can be achieved by making the conductor as thin as possible in relation to the cladding.

The ferrite cladding may be of any convenient form. It may be a coating formed in situ or it could be achieved by sliding ferrite 'beads' onto the conductor. One end of the aerial can be left bare to permit final trimming to a desired resonant frequency. Additional support and protection can be provided by a sheath of insulating material.



One other important practical advantage is that in many cases the ferrite cladding produces a higher input impedance at resonance than a corresponding dielectric-clad aerial. Difficulties sometimes arise in matching the low input impedances associated with dielectric aerials to their associated circuitry. The input impedance can be further increased by feeding the monopole at an intermediate point along its length rather than its base.

While ferrite cladding can, in principle, be applied for any frequency in the HF or VHF bands, practical frequency ranges to which it can at present be applied are largely dependent on the availability of suitable materials having the required low-loss magnetic properties. The lack of existing low-loss ferrites at high frequencies places an upper limit of about 100 MHz on most applications, although this could be considerably extended should new materials become available. At the lower limit of the HF band, the practical limit of about 5MHz is determined by the familiar problem of the bulky cladding thicknesses required.

Although the major application of ferrite cladding is expected to be in monopole whip aerials, it may well prove useful in other antenna configurations such as dipoles, Yagi arrays or wire-grid wideband structure, perhaps with different elements clad in different materials.

Companies interested in manufacturing ferrite-clad aerials based on this principle are invited to contact Jim Strutt, Computers, Systems and Electronics Group, National Research Development Corporation, Kingsgate House, 66-74 Victoria Street London SW1E 6SL, UK. to discuss licensing arrangements.

Sequential Temperature Programmer

The programmer developed at the National Aeronautical Laboratory, Bangalore is used for sequential programmable variation of temperature with any temperature regulator.

This unit, as developed, has the special capability to work under highly noisy industrial environment. Programmer units for long duration programmes (say in hours) usually employ an arrangement of a stand-by-motor-generator supply. The switch-over from mains to the stand-by supply takes place usually in 2 seconds or so. This is accompanied by large transient pulses. Programmers designed with low noise immunity logic devices, will be adversely affected by such transients. Such effects are eliminated in the present programmer by using uni-selectors.

This programmer consists of 4 main blocks viz., variable clock generator, frequency divider, stage selector and the stepper motor with translator, as shown in the block diagram. The variable clock generator is used to achieve different rates of change of (increase or decrease) temperature. The setting for the same is brought in the form of a rotary switch in the front panel with 10 setting positions.

The clock frequency is divided suitably to achieve long time delay with a uniselector switch, which is an electro-mechanical device and hence has very high noise immunity. This clock is divided here in 3 or 4 steps depending on the total delay required.

This divided clock goes through the stage selector which selects the direction of rotation of the stepper motor. In other words, it decides whether the temperature has to increase or decrease at the set rate. Presently the programmer, as developed, has 4 stages. In one stage the temperature will increase as per the rate setting; in the next stage, it will stay at the set maximum temperature for set period. In the next stage the temperature decreases at the same set rate to the set temperature and in the final stage it remains at the minimum temperature for the set period. The stage can be increased to more than 4, if desired.

The translator gets the signal from the frequency divider step through the stage selector and hence the stepper motor turns accordingly. The motor shaft can be connected to any temperature controller whose temperature is set by potentiometer knob.

Front Panel Control and Setting

1 Clock or rate setting: This is a rotary switch with 10 positions. Each position corresponds to particular degrees per hour. The rate for each step will be determined by knowing the maximum temperature of the temperature controller which is going to be fitted in this unit.

2. Thumb wheel setting: There are two thumb wheels for indicating cum setting each stage. This will correspond to the total duration of each stage.

3. Control of setting heating and cooling of each stage

4. Reset to initialise the whole process

Technical Specifications

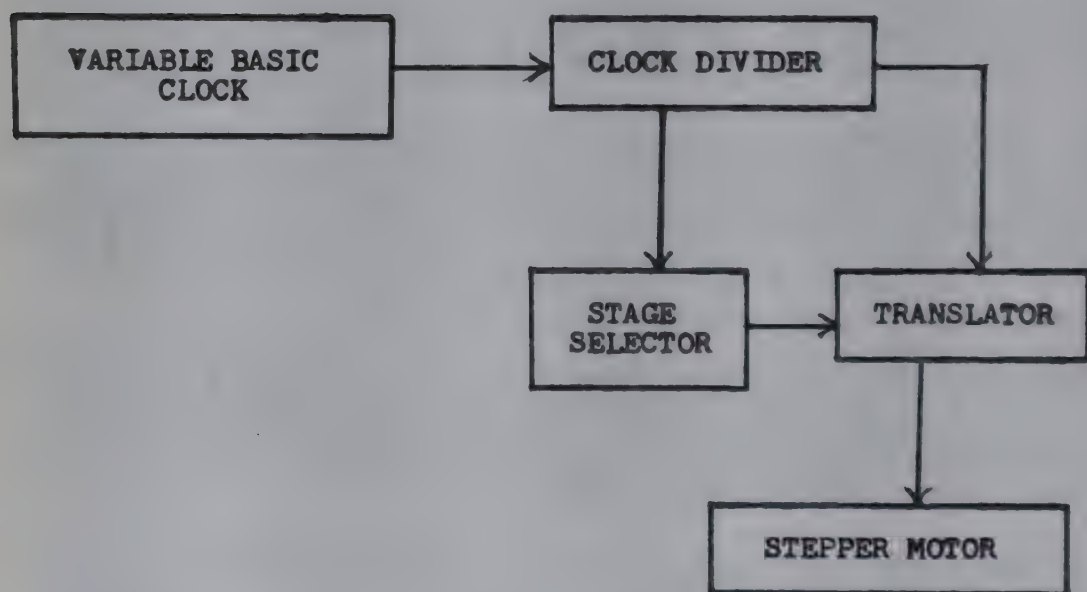
Mains operation	:	230 V, 50Hz
Number of stages	:	3 to 12 (more if necessary)
Output steps	:	200 per revolution
Period of each step	:	0.5 min-25 min
Duration of each stage	:	Minimum - 10 minutes
		Maximum-500 min (can be increased if necessary)

The main equipments required will be hand-drill, sheet metal shearing and bending machine, multimeter stop watch etc. All are available indigenously.

The main raw main raw materials required will be semi-conductor devices, stepper motor, unisector, thumb wheel switches, 3 position switches, on-off switch and lamp, start switch, stop switch, clock selector, fuse and fuse holder, power supply 35 V, 2 A (unregulated), sockets, miscellaneous items like resistors and capacitors etc. All are available indigenously.

To set up a plant to manufacture 35 nos. per annum, the total capital investment has been estimated at Rs 50,000 and the cost of production per unit at Rs 3,000.

BLOCK DIAGRAM



UHF Airborne Sleeve Antenna (225-400 MHz)

It is used with equipment for air to ground communication. The antenna is basically a monopole above ground plane and consists of two parts connected together by coaxial stub. A matching section is introduced to make the antenna broadband. The antenna works in the frequency range of 225-400 MHz.

The Defence Electronics Research Laboratory (DRDO), Hyderabad has developed one antenna which conforms to the specifications BS-2G-100 Parts 2. Aircraft and System Testing Establishment, Bangalore has cleared the antenna for fitment on aircraft and airworthiness certificate has been given by Directorate of Aeronautics.

Specifications of Product

Frequency range	:	225-400 MHz
VSWR	:	2:1
Weight	:	750 gms. (Approx.)
Dimensions	:	230 mm x 93 mm x 22.5 mm
Pattern		
(a) Horizontal	:	Circular
(b) Vertical	:	Cosine shape

The main raw materials required are aluminium ingot, aluminium sheet, teflon rod and sheet, brass rod, beryllium copper, nylon tube. All these raw materials are available indigenously.

Mechanical facilities like lathe/shaping machine/aluminium casting facilities are needed for the fabrication of the antenna. No separate plant would be necessary for a firm/industry having mechanical facilities for turning/shaping, milling etc., and already having experience in the production of antenna.

The main test instrument required are impedance bridge, field strength meter, VHF/UHF signal generator. All these test instruments are not available indigenously and are to be imported.

The manufacturer should be in a position to get the testing of the following parameters done:

- i) Radiography test
- ii) Vibration/Endurance test
- iii) Static loading test
- iv) Wind tunnel test for Mach two wind speed

These tests are to be conducted apart from the electrical tests like VSWR, Polar pattern, power handling capacity etc.

Cost of Production : Rs 3,500/- approximately.

Production prototype will have to be subjected to type approval/test by Directorate of Aeronautics, R & D Hqrs. Ministry of Defence, New Delhi again before the clearance for use on aircraft on payment.

ENGINEERING INDUSTRIES

Low Cost Windmill

Researchers at the Central Arid Zone Research Institute, Jodhpur, have fabricated a low cost sail windmill using locally available materials, at an approximate cost of ₹ 2800.

The windmill consists of an auto directional assembly with crank which ensures quick response to the changing direction of the wind. The rotor or the fan assembly is driven by the kinetic energy of the wind. The wind power is converted by the rotor to shaft power which is transmitted to the crank and further to the water pump. The fan assembly has three wings made of canvas cloth in triangular shape and are installed on bamboo poles of 4 m length. The wings are mounted on a disposed brake drum. The tension on the wings is maintained by springs attached to each wing.

The wooden tower of the mill is 5.8 m. high and is made from locally available and cheap Dhawara round poles treated with bitumen and Aldrex to protect them from white ants and soil effects. The tower is robust enough to withstand wind storms. The diameter of the entire windmill assembly is 6.7 m.

The pump used in field trials is of reciprocating type with a brass cylinder of 6.4 cm diameter and 22.5 cm stroke and is readily available in the local market.

The preliminary results indicate that the performance of the mill on days with average wind speed exceeding 8 km/hr. was satisfactory. The quantity of water pumped increases steadily from 200 litres/hr. at a wind speed of 8 km/hr. to 1100 litres/hr. at a wind speed of 18 km/hr. Further increase in wind speed has little effect on the quantity of water pumped because of the limiting number of strokes of the water pump. To ensure safety of the windmill under high wind speed conditions and to avoid water hammering, the spring mechanism attached to the wings alters the direction of the wings considerably and so reduces the number of revolutions of the rotor that they match with the maximum number of strokes of the pump.

The windmill is also capable of pumping water from a level of 3.5 m. below the ground at an average rate of 1050 litres/hr. on days with a mean daily wind speed of 1520 km/hr. and of 1250 litres/hr. on days with a wind speed of 26 km/hr. Water outputs of 1250 litres/hr. at 15 km/hr. wind speed have also been obtained.

For further details please contact Dr. SD Chowdhry at Central Arid Zone Research Institute, Jodhpur - 341 001. Rajasthan.

MAGNETIC TAPE COATING UNIT

The use of magnetic tapes for audio, video and instrumentation applications has increased manifold over the last two decades or so. Commercially, the production type units available can coat several thousand metres of tape ranging in widths from 600 to 1200 mm, and requiring a charge of 5-10 kg. of pigment per run. Such units are not suitable for obtaining tapes from small quantities of laboratory samples of magnetic powders for performance evaluation.

With this in view, the National Aeronautical Laboratory (NAL), Bangalore, has developed a laboratory scale magnetic tape coating unit for coating very small quantities of magnetic oxide pigments on polyester (mylar) or other substrate tapes. The unit will be used for testing some of the Chromium dioxide and alloy-tapes that are under development in the laboratory.

The unit comprises basically a feeder spool for carrying the polyester tape in roll form, a dispersion tank fitted with 9 pick-up cum coating-rollers essentially for transferring the magnetic oxide pigment on to the underside of the tape and a magnetic coil for orienting the particles (while still wet) longitudinally along the length of the tape. A set of drying lamps has been provided for drying the wet tape, which then supports on rollers under their illumination. The coated tape is cut to an appropriate width by a tape splicing assembly. The entire set of movable parts is driven by a motor.

Experiments carried out in the laboratory have indicated satisfactory operation of the unit. The unit is now being upgraded to incorporate polishing rollers to polish the tape to level and to yield a good and uniform surface finish. It is also planned to incorporate in the system facilities for measuring and controlling the thickness of coatings precisely, as well as to increase the coating width to 100 mm or more.

Solar Water Pump

A solar-cell operated water pumping system designed and manufactured by the Central Electronics Ltd.(CEL), Sahibabad has been installed in the un-electrified village of Awania in Gujarat.

The system consists of 16 solar photovoltaic modules manufactured by CEL, two lead-acid truck batteries and a DC motor-pump set of 125 watts capacity, also made in India. The total photovoltaic array capacity is 112 peak watts, covering an area of 2.1 sq-meter. Provision for manual tracking, thrice a day is also provided in the array structure. The generated electrical energy from the photovoltaic array is stored in the lead acid batteries, which in turn, deliver the energy to the

motor pump set. The water output from the motor pump set is approximately 2,000 litres per hour, with a daily output of about 7,000 litres. The storage batteries take care of cloudy days, when the photovoltaic array does not produce much electrical energy. In addition the same array and battery combination can be used for lighting 3 or 4 fluorescent tubelights, each of 6 watts capacity.

The system has been installed to supply drinking water, using only solar energy. The basic purpose of this installation is to study its performance in rural environment and its social acceptability. For this purpose routine studies are being performed and analysed by Central Salt and Marine Chemicals Research Institute, Bhavanagar in collaboration with CEL.

For further details please contact Dr. BMS Bist, Research Scientist, Solar Photovoltaic Project, Central Electronics Ltd., 4, Industrial Area, Sahibabad 201 010.

New Machinery and Equipment

ELECTRONICS AND ELECTRICAL EQUIPMENT

Digital Indicator

For the first time in the country, Technolab Instruments (Madras) has introduced remote reading digital level indicators and controllers.

The digital level indicator and controller can be used for remote monitoring of levels, with minimum and maximum or proportional level control. The transducer is connected to the process at the bottom of the vessel by a small pipe line. It is electrically connected to the digital indicator by cable. The indicator can be mounted as far as 50 M. away for measurement and monitoring.

The instrument can be used for determining level of water, oils, acids, chemicals, slurry solutions etc. As very low voltage and low current transmission take place, the instrument can be safely used in hazardous areas also. The instrument can be supplied for any level ranges upto 10 metres.

For further details contact: Technolab Instruments (Madras), C-52, 1st Floor, Annanagar, Madras - 600 102.

Digital Multimeter

PLA Electro Appliances had developed new digital multimeter type DM-14. It is a hand-held 3-1/2 digits multimeter covering 29 voltage, current and resistance measurement ranges and is housed in decent and modern style well designed attractive case. It is powered by a standard 9V transistor battery providing 100 to 200 operating hours. The input circuitry is protected for continuous application of voltage upto 700 V RMS or 1000 V DC on all range except 200 m V range.

Its display is a long life liquid crystal display of 0.5" height providing an excellent readability in all light conditions, indoors and outdoors.

The most important feature of DM-14 is that resistance ranges are fully protected upto 450 V AC/DC voltage.

For further details contact: PLA Electro Appliances, Thakor Estate, Kurla Kiroli Road, Vidya-Vihar (West), Bombay-86.

Echo Chambers

Ashok Electronics have developed a new product called "Echo Chambers" in India. These echo chambers are used in Orchestras parties, auditoriums, film shootings, beat groups, publicity, announcements, etc.

There are two types: CO series and PO series. CO series is used for commercial purposes and PO series for professional use.

Exclusive features are: Inputs: magnetic P.U. ceramic P.U., tape, tuner and mike. Tape out for recording purposes is provided, repetitions are continuously adjustable from zero to ten; adjustments/controls like original output, echo output, speed of echo, mixed output, etc., are provided; echo enable to avoid unwanted echo by mistake; reverberation depth continuously adjustable, output impedance less than 20 K ohm; distortion less than 0.1 per cent.

For further details contact: Ashok Electronics, 11 Tinwala Building, Tribhuvan Road, Bombay - 400 004.

Solid State Relays

A revolution in the field of electronic relays is being made through the introduction of solid state relays. These solid state relays are stepping into India through Electronic Relays (India) Pvt. Ltd., with the technical collaboration of Electronic Relays, Inc., USA.

The first product of Electronic Relays (India) Pvt. Ltd., is 'AC Solid State Relay', which is the first of its kind in the country. The dimension of this relay is: length 7.2 cms., breadth 4.45 cms., height 2.54 cms. and the weight of the relay is 113.4 gms. Even with this small size, this relay can switch AC peak loads of 400 V, 10 A, 400V 25A, 600V 10A, 600V 25A, 1200V 25A, 400V 40A, which is of course impossible to achieve with the conventional relay. This relay is having only one N/D contact.

This relay employs a special technique called 'Zero Voltage Switching' which in turn much reduces the radio frequency interference in the electronic systems. The input voltage required for the relay operation is 3 to 32 V DC. The relay can be easily interfaced with either TTL or CMDS circuits. This relay is optically coupled. Hence, the input and output are completely isolated, the isolation voltage between the two is 2500 AC. The input current and input impedance is 2M A and 1500 ohm.

This relay can be chassis mounted either it can be mounted on heatsink or it can be soldered to the printed circuit board depending upon the design requirements. The relay can be operated to its full load by using the proper heatsink.

Since the relay does not consist of any moving part, the life of the relay is long and the reliability is more. These relays can easily replace Crydom, Teledyne, Hamlin and other leading manufacturers of solid state relays in USA. This relay is consigned by underwriter laboratories, Canadian Standards Association, British Standards Institution and others.

Electronic Relays (India) Pvt. Ltd., will also be manufacturing a variety of solid state relays which are useful in different switching applications.

Details from: Electronic Relays (India) Pvt. Ltd., 45/12, 11th Cross, Gubbanna Industrial Estate, VI Block, Rajajinagar, Bangalore - 560 010.

ENGINEERING EQUIPMENT

Cutting Machine

Macman Engineers (India) has developed a new cutting machine suitable and adjustable to cut tiles, refractory bricks, refractory blocks, glazed pipes, natural stone, concrete block, marble etc.

The machine called Mason, has a foot operated cutting head leaving the hand free to move the rollomatic table below the wheel. Through the foot linkages is a noval stabilizer spring (for safety) to automatically adjust the pressure on the blade.

Outstanding features are: dynamically balanced spindle assembly: the head can be raised or lowered on the notches according to the size of the material; the head is adjustable to the desired depth by instant release and locking in the desired position; the cutting pressure on the blade is controlled by a stabilizer spring; bottom blades guard for total safety to the operator; instant locking of cutting head at any desired position and belt tensioning device.

It has centralized control panel with R.Y.B. indicating lamps for 3 phase supply, indicating lamps for motor and pump, push button for motor and switch for coolant.

For further details contact: Macman Engineers (India), Elar Building, Behind Swastik House, 524, Senapati Bapat Marg, Dadar, Bombay - 400 028.

Piston Pump

A Dutch manufacturer has developed a special pump for use in well drilling operations, which is basically a normal duplex piston pump with certain special features.

One of the pump's most important features is the interchangeability of cylinder liners and pistons. By varying the diameters of these, it is possible to select specific pressures and deliveries. Another important advantage is the fact that the overall length of the pump, when placed in the transverse direction across a truck, is within the admissible limits for road haulage. This means that no special transport facilities are required.

The use of the waterjet drilling method in combination with this pump enables holes to be drilled with a greater diameter than was hitherto possible. This produces a greater productivity than if the same holes were to be drilled by the suction drilling method.

The pump's most important features are: a wide range of cylinder liner diameters (from 3" to 7-1/2"); maximum pressure of 96 bar (with the 3" version); maximum delivery of 2,200 l/min. (with the 7-1/2" version); length and weight 2.45 metres and 2,700 kg. respectively.

Additional information from Conrad-Stork B.V. Postbus 134, 2000 AC Haarlem, Netherlands.

Screw Press

The screw press is suitable for pressing variety of seeds, such as cotton seeds, copra, groundnuts etc. In designing such a unit, the main aim was to overcome the disadvantages in the existing units.

Tekma screw press ensures trouble free performance and optimum oil extraction under all working conditions. A wide range of models is available, the choice of the model is being determined by the capacity requirement of the oil mill. Main difference is in the capacity and the quality of the oil extracted from a given ton of seed in a given period of time.

The main shaft: plays an important role in low maintenance costs and high pressing efficiency. All parts subject to wear are properly heat treated.

The main body: of Tekma Jumbo screw press is a robust steel construction designed to withstand heavy working conditions.

Pressing chamber: Plates are used to fabricate the chamber box so that it can bear heavy pressure necessary to get optimum oil from the seeds.

Barrel bars: Surfaces of barrel bars are saturated with innumerable Carbide particles to form hard, abrasion resisting even surface that prevent quick wear down as in case of ordinary steel.

Gearbox: Gears are processed from selected seasoned alloy steel castings. Pinions are also fabricated from special steel. All gears have precision cut teeth and are inspected to ensure noise free performance under running conditions. All the gears run in an enclosed oil bath.

Cooker conditioner: Preheating of seed before pressing is necessary to get maximum oil from the seed. The Cooker Conditioner is a vertical stack type, where seed is thoroughly heated before entering the pressing chamber for oil extraction.

Cone adjustment: Cone position can be adjusted without any difficulty for putting maximum pressure on the cake at the discharge end.

- Maintenance:
- All standard ball and roller bearings are used to afford easy replacement when they wear out.
 - The Chamber can be removed easily for replacing shaft parts and barrel bars.
 - The main shaft can be withdrawn without disturbing the main gear driving arrangement thus causing minimum difficulty in carrying out repairs.

Features

Model Jumbo	I	II	III	IV	V	VI
Capacity Tons/24 hrs. (approx.)	3-5	6-7	9-10	12-14	25-28	40-45
Power reqd. (approx.)	15	20	25	35	50	110

Further details from: Tekma Industries, P.O.Box 8931,
Bombay - 72(India), Works: 48-B, Saki Vihar Road, Bombay - 72.

Tungsten Carbide Applicator

Tung-Caro is claimed to be the latest development in carbide tooling. Babe Manufacturing Co., USA has developed this lightweight tool (weighs only 9 oz) which electronically fuses tungsten carbide or titanium carbide from the electrode into the pores of the surface to be treated.

The tungsten carbide electrode vibrates 120 times a second. A solid state electronic circuit in the tool supplies an electric current synchronous with the vibrations. Each time the electrode contacts the work, a tiny particle of tungsten carbide is fused into the surface. For every .0001 deposited below the surface, an equal amount is above the surface and the electrode may be passed over the surface as many times as necessary to cover the area completely. A professional job can be accomplished with only a few minutes practice.

The metallurgical bond of this coating is so great that nothing can dislodge it and it increases tool life upto 1000 per cent. It requires no external heat for application and allows increased cutting speed. It is excellent for use on stamping dies, drills, lathe tools, gear cutters, worm cutters, extrusion dies, etc.

For further details contact: Western-work International Divn., of Western Mfg. Co. (Bombay) Pvt. Ltd., 5-D, Vulcan Insurance Building, Vee Nariman Road, Churchgate, Bombay - 400 020.

Industry Roundup

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

SAFETY RAZOR BLADES

Safety razor blades are made out of steel. Steel strips of required quality and thickness are cut into strips of standard size which are then given the desired shape. The sides of the cut pieces are sharpened to give close tolerances. These blades are made in several forms viz., double edged blades, single edged blades, sandwich blades, bounded blades, etc. Double edged blades are overwhelmingly in use in our country. The double edge blade is fitted into a safety razor before use.

Production of Safety Razor Blades in India

In India, the production and use of stainless steel blades are of relatively recent origin. The practice is, however, increasing at a rapid rate. Most of the safety razor blades manufacturers follow the standards developed by the Indian Standards Institution viz., ISI: 7371/1975 for double edged safety razor blades.

The production of razor blades is of recent origin in India. The first unit to manufacture blades went up in 1951. Production of blades rose subsequently. Table 1 provides the data on a number of units and the installed capacity and production of safety razor blades in India as under:

TABLE 1
Number of Units, Installed Capacity and Production
of Safety Razor Blades (Million Number)

Year	No. of Units	Installed Capacity	Production
1969	6	2,035	914.60
1976	7	2,095	911.90
1977	7	2,530	984.60
1978	7	2,680	1100.00
1979*	7	2,680	1350.00

* Upto August 1979

There are seven units in the manufacture of these blades with an installed capacity of 2,680 million numbers per annum as in Table 2.

TABLE 2

Name of the Manufacturers and Unit-wise Installed
Capacity of Safety Razor Blades

Unit	(Million Number per annum) Installed Capacity
Harbans Lal Malhotra & Sons Pvt. Ltd., Calcutta	1500 (56.0)
Vidyut Metalics Pvt. Ltd. Bombay	90 (3.4)
Indo-Swiss Pvt. Ltd. Hyderabad	250 (7.5)
Sharpedge Limited New Delhi	200 (7.5)
National Razor Blades Calcutta	100 (3.7)
Industrial Alliance Ltd. Bombay	250 (9.3)
T.T. Blades Bombay	290 (10.8)

Note: Figures in brackets are percentages of the total.

One unit has developed limited production of single track plastic bonded type blades. The industrial licenses or registration have been granted to 11 units for a total capacity of 3530 million numbers. This includes, the units which are already in production. In addition to above a letter of intent has been given to one more unit for a capacity of 250 million numbers a year. After 1969, only one unit has come up and the installed capacity has been significantly increased. It has gone up to 40 per cent during the period of 1969 to 1979. Thus the increase in capacity has largely come from the expansion of existing units. Production has increased to 48 per cent between 1969 and 1979 and it has gone up significantly during 1979 as in Table 1. The capacity utilization does not present a fair state of affairs. Even during 1979, it has remained fairly low. There are several reasons for this. First, the demand for safety razor blades has not risen as expected. Secondly, only 4 out of 7 units with an 80 per cent of the total are really operating properly and the remaining

3 units contributing little to the total production for the reasons that follow. Thus only the 'effective' installed capacity of the 4 units in the industry is taken into consideration. The utilization status is not as discouraging as it appears at first sight. Thirdly, the raw materials for the manufacture of blades are imported from abroad and owing to restraints on foreign exchange, the inflow of this is sometime insufficient to guarantee higher capacity utilization. Fourthly, the export demand for blades is comparatively low and has not increased fast. It may, however, be stated that the principal reason for low capacity utilization is the slow growth in demand for blades over the years. It is interesting to note that all the units manufacturing safety razor blades are enlisted with DGTD.

Type-wise Production Situation

The production of safety razor blades are of two types viz., (i) Carbon Steel Blades and (ii) Stainless Steel Blades. The former is made out of carbon steel strips while the latter i.e., S.S.Blades are made out of stainless steel strips. A stainless steel provides a larger number of shaves as compared to a carbon steel blades and thus the former is superior to the latter, and is therefore priced higher.

In the international market the demand for double edged blades is quite high for stainless steel blades. In India, the share of S.S.Blades in total is increasing rapidly. Table 3 shows the production of carbon steel and S.S.Blades in India.

The share of S.S.Blades in 1969 in the total production was only 7 per cent and it has been increased to 44 per cent by 1976 and hiked up to 71 per cent in 1977. Thus, production over the period displays a great qualitative shift, though in quantitative terms the increase is slow. The increased acceptance of S.S.Blades by consumers is the reason for this change.

Exports of Blades

Blades are used in all parts of the world. There is a large scale international export since most of the developing countries do not have facilities to manufacture this product. Usual customers of blades are mainly from the countries in the Middle East Asia. Table 4 shows statistics on exports of blades from India during 1972-73 to 1977-78.

TABLE 3

Type-wise production of blades in India 1969 - 1977

(Million Number)

Year	Carbon Steel	Stainless Steel	Total
1969	847.2 (92.6)	67.4 (7.4)	914.6 (100.0)
1970	837.0 (89.6)	99.6 (10.4)	936.6 (100.0)
1971	558.5 (18.9)	123.7 (18.1)	682.2 (100.0)
1972	829 (74.2)	258.8 (25.8)	1118.7 (100.0)
1973	648.0 (64.5)	366.2 (35.5)	1004.2 (100.0)
1974	529.8 (58.2)	381.2 (41.8)	911.9 (100.0)
1975	615.9 (59.9)	413.0 (40.1)	1028.9 (100.0)
1976	512.0 (56.1)	399.9 (43.9)	911.9 (100.0)
1977	286.0 (29.0)	698.0 (71.0)	984.6 (100.0)

TABLE 4

Exports of Safety Razor Blades

Year	Exports		Unit Value Rs/blades
	Quantity (Million No.)	Value (Million Rs)	
1972-73	36.32	1.04	0.03
1973-74	54.99	1.64	0.03
1974-75	59.89	4.45	0.07
1975-76	51.09	2.91	0.06
1976-77	42.38	3.23	0.08
1977-78	60.08	5.67	0.09
(Upto December, 1977)			

Exports of blades have increased by 60 per cent in terms of quantity and by about 500 per cent in terms of value during the period under consideration. The improvement made in the quality of blades exported and general price rise experienced globally have resulted in the increase of higher rate in value which is reflected in better unit value realization over a period of time. When we compare the total domestic production, the export of blades is at about 8 per cent in terms of quantity. This is primarily due to the following reasons:

1. Exports are undertaken by the Indian manufacturers mainly to meet the government's stipulated conditions. Thus they export, primarily by compulsion and less by choice.
2. The international market is highly competitive.
3. The international market is highly quality and brand conscious; and
4. Lastly the marketing efforts overseas have to be backed by advertising campaigns, high quality maintenance, regularity of supply, etc.

Therefore, the promotion of export of blades to the traditional buyers and the penetration in new markets would be achieved by vigorous efforts on several fronts.

Demand for Razor Blades

The figures for apparent consumption of razor blades are obtained by consideration of production figures, and not of exports, with the implicit assumption that imports are absent as in Table 5.

TABLE 5
Apparent Consumption of Razor Blades

(Million Numbers)			
Year	Product	Exports	Apparent Consumption
1972	1,118.7	36.3	1082.4
1973	1,004.2	55.0	949.2
1974	911.0	59.0	851.1
1975	1,028.9	51.1	977.8
1976	911.9	42.3	869.6
1977	984.6	60.1	924.5
(April-Dec.)			

It is remaining stagnant over the last 6 years and infact it has declined slightly during 1976 and 1977.

The demand for razor blades is primarily concerned with their price and quality, the size of the adult male population and their income levels and shaving habits and is also difficult to quantify these variables to fit a demand function. Here, one attempt is made to assess the demand potential of the market by 1983, based on the information on estimates of population during 1983 as in Table 6.

TABLE 6
Population Estimates 1983

Estimate	Value (Millions)
Total Population	697.20
Urban Population	156.70
Urban Male Population	84.61
Urban Adult Population	52.29

In the urban areas, the market is likely to be 52.29 million adult males in 1983. In the absence of any definite information on the males aged around 16 years onwards who do not go for shaving, it is assumed that 10 per cent of the adult males would not shave with the help of conventional blades. Thus the number of effective buyers in the urban area would be 47.06 million in 1983. Assuming 200 shaves a year per adult male, the total number of shaves in 1983 would amount to $47.00 \times 200 = 9,412$ million. The number of shaves obtained from a blade depends on the quality of the blade and the user's beard. For carbon steel blades it will be less than stainless steel blades. On an average 3 shaves can be obtained from a carbon steel blade and about 10 shaves from a stainless steel blade which is made in India at present. The weighted average of the two blades comes to about 8 shaves per blade. Taking 8 shaves per blade for 9,412 million shaves, there would be a requirement of 1,175 million blades. Rural India offers a market potential to the extent of 40 per cent in the total. Taking this percentage, the aggregate at India, market potential amounts to 1,960 million blades during 1983.

Also, the extent of realisation of this market potential will mainly depend on the trends in income growth, the prices of blades and the shaving habits of the people. In addition, there would be scope offered by the export market at least to the tune of 100 million units. Thus the aggregate demand, is likely to be in the range of 2,100 million units during 1983.

Demand and Supply Position

The total capacity in the industry by 1978 was of the order of 2,680 million numbers. Four more units with an additional licensed or registered capacity amounting to 850 million number per annum are likely to come up. With this additional capacity, the industry will take care of the potential demand during 1983. The balance of supply and demand of razor blades will therefore largely depend upon the progress made by the existing licensed units in achieving their capacity.

Industrial Policy

The existing units having comparatively lower capacity will be encouraged to (i) achieve better economic scale of production and (ii) modernise and improve the quality of blades manufactured by them. Schemes by way of diversification, from existing units for the manufacture of more sophisticated types of safety razor blades, such as, single and double track bonded blades etc., which would help in modernisation and conservation of imported raw materials may also be considered on merit. Such proposals should be supported by a detailed project report along with the details of the manufacturing arrangements proposed.

The overall capacity approved vis-a-vis the projected future demand would seem to indicate that at present there is no scope for creation of additional capacity for the production of standard type double edged safety razor blades. However, a number of industrial licenses are yet to be implemented, keeping in view, the need for increased availability of quality blades, at reasonable prices for the consumers. Proposals for establishment of new units in collaboration with firms of international repute in the razor blade industry can be considered in exceptional cases. Foreign technical collaboration can also be considered on merits. (SS)

Current Technical Literature

Copies of articles/documents listed in this section are available on payment of ₹ 5/- for the first 5 pages or part thereof and ₹ 1/- for every subsequent page of the photocopy or xerox copy of the article/document. While placing the order, please mention the CTL number of the SENDOC Bulletin.

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CURRENT TECHNICAL LITERATURE

SCIENCE AND TECHNOLOGY

Technology Transfer

426. AHMAD A: Technology assessment: The state of the art in India. Journal of Scientific and Industrial Research 1980, 39(3), 125-131.

The present work is a brief conceptual and methodological exposition of technology assessment (TA) as a tool for making appropriate technology choices. Socio-economic, environmental and certain other consequences of technologies have brought home the need for TA as a prerequisite to sound technological decisions. While TA has been around for a while in advanced industrial societies, developing countries like India - in their haste towards technological development - have remained insensitive to the need for prior assessment of technologies on a comprehensive basis. Some conceptual and methodological guidelines have been provided for building up proper expertise for technology assessment in India. A strong case has been made for institutionalizing technology assessment at various locations in society, both governmental and non-governmental, so that rational and impartial assessment could be made independent of the vested interests. (AA)

427. INDRADEV: Technological forecasting and the planning of R & D strategies. Journal of Scientific & Industrial Research, 1980, 39(4), 179-184.

This paper describes some of the approaches which companies can adopt towards R & D done in their industrial units. Some techniques of planning R & D at the macro-and micro-levels, particularly the use of TF, are discussed. R & D in industry is done mainly to maintain market viability in the face of rapid technological changes. Companies adopt either the normative approach wherein corporate (market/technological/financial) goals are set and R & D is initiated to achieve them, or the company encourages exploratory research in various disciplines in the hope that profitable products/processes will emerge from it. TF helps in selecting the strategy and the area of research and also in identifying research projects and in their planning. R & D strategy is described in the form of defensive and offensive research. In early stages of planning, research projects are chosen through branching networks. Examples of the use of TF in R & D in India and abroad are given. (AA)

FOOD AND ALLIED INDUSTRIES

428. ----: Can we make cheaper food for the millions?
Indian Chemical Abstracts, 1979, 1(5), 4-10.

Surveys the food processing industry in the country the major sectors of which comprise: bakery products, fruit and vegetable products, meat and poultry products, milk and dairy products, confectionery, instant tea and coffee. The number of units, installed capacity and production in the organised sector are presented. The problems faced by the food processing industry, the exports over the years upto 1977-78, and the R & D efforts needed for development of new food products/technologies are discussed. (JBS)

429. ----: Dairy development: Scope for private sector for end-use industries. Industrial Researcher, 1979, 6(1), 17-25.

Focuses attention on the growth of the dairy industry in India and examines the scope for future development.

430. JAIKUMAR, R: Fruit and vegetable processing industry, Problems and prospects. Ex-Imp. Times, 1980, 2(29), 15-21.

431. MAHAJAN BM et al: Production and shelf life of spray dried srikhand powder. Journal of Food Science and Technology, 1979, 16(1), 9-11.

After several trials, 150 litres of milk spray-dried srikhand powder was prepared from cow and buffalo milk. The product was gas packed and stored for 90 days at 30-1° C. The moisture content and volatile fatty acids in Srikhand powder during storage were more or less stable but there was a rise in free fat. Reconstituency and flavour of both products were satisfactory for about 45 days. Thereafter storage of the buffalo Srikhand powder was less satisfactory. (AA)

432. POCHKHANAWALA N.S.: Reflections on the food industry in India. Indian Chemical Abstracts, 1979, 1(5), 18-21.

433. SINGH NARENDRA: Scope for leaf protein in rural areas. Research and Industry, 1979, 24(3), 149-151.

The scope for integrating leaf protein production technology with the prevalent agricultural, dairy and poultry practices in rural areas is discussed. A production-cum-utilization programme covering such aspects as the equipment needed, the estimated investment, optimum scale of production and the ideal mode of utilizing the product is outlined. (AA)

434. VILASA C.T.: Nutritive value of cashew apple. Cashew Bulletin, 1979, 16(2), 9-10.

Discusses the nutritive values of the constituents of cashew apple. Suggests the production of edible products like juice, syrup, jam, chutny and pickle.(MSR)

CHEMICAL INDUSTRIES

435. ----: Industry Profile - Chemical Industry (1) Industrial News Digest, 1978, 1(10), 1-4.

Reviews the present status of chemical industry with special reference to basic inorganic and organic chemicals, dyes and intermediates, drugs and pharmaceuticals and the small scale sector.

436. ----: World chemical outlook. Special report. Chemical & Engineering News, 1979, 57(52), 22-47.

The world's chemical industry is becoming integrated and closely knit. With the fast rising raw materials costs, more slowly growing demand and increasing competition, the world's chemical economy is more fragile than the buoyant record of 1978. Chemical capability in Latin America, Western Europe, Japan, Canada, USSR/Eastern Europe, China and Middle East is reviewed. (JBS)

437. AGBASE G et al: Pilot plant studies on use of a rotory drier for roasting. Chemical Age of India, 1979, 30(11), 995-1007.

The effect of combinations of several variables such as the speed of revolution and inclination of drum, feed rate, temperature, air velocity and residence time distribution on roasting and drying of groundnuts was investigated using a rotary drier pilot plant supplied by Bench Scale Equipment, USA. Based on the experimental observations, optimum conditions were determined and scale-up calculations performed to predict the behaviour of a prototype.

438. KHARBANDA O.P.: Ammonium sulphate. Chemical Weekly, 1979, 24(25), 48-51.

Typical process flow chart and techno-economic details are briefly given. Names of manufacturers with their capacities are also listed out. (MSR)

439. KHARBANDA O.P.: Carbon black. Chemical Weekly, 1979, 24(26), 84-87.

Outlines of the process and producers with their capacities of carbon black are given. Future demand, price and technoeconomic details are briefly discussed. (MSR)

440. KRISHNAN P.P. et al: Greases: Their selection and care. Textile Machinery Accessories & Stores, 1979, 15(5), 11-13.

Enumerates the general characteristics and operating requirements of greases. Highlights their selection procedure. (BS)

PLASTICS

441. ----: Industry profile - Polyvinyl Chloride resins. Industrial News Digest, 1980, 3(2), 3-5.

Gives details of production, licensed and installed capacities, consumption and demand, export and import. (JBS)

442. HOLLAND M.B.: Plastics coatings. Chartered Mechanical Engineer, 1979, 26(1), 43-45.

The use of plastics coatings to combine the surface properties of plastics with the structural properties of metals is becoming increasingly widespread as designers recognise the potential economic advantages of this form of construction. Examines the types of coatings available, their methods of application, their strengths and their weaknesses. (AA)

443. JOHANNABER F: Drying of plastics. Technical File No. 68. Engineering, 1979, 219(8), 1-viii.

Moulding with improperly dried plastics can give a finished product with unsatisfactory surface finish and unsatisfactory properties, both as regards strength and dimensions. This technical file is limited to those drying processes which are either necessary or customary immediately before or during injection moulding. Drying proceeds approximately according to the laws of diffusion and moisture equilibrium defined for ideal conditions. Processes involving presses, centrifuges, exhaustion with vacuum support and absorption by hygroscopic additives are not dealt with since they either admit only moderate degrees of drying or necessitate unacceptably high capital expenditure.

444. SHARMA S.K. & VERMA R: FRP as a material of construction in process industry. Chemical Age of India, 1979, 30(6), 519-529.

Highlights the applications and the advantages of fibre reinforced plastic, (FRP) over conventional corrosion resistant materials, fabrication methods in the construction of FRP equipment and indicates the general design features of FRP equipment. (KSDR)

445. SRINIVASAN S.R.: Growth prospects of polymer industry in India. Colour & Chemicals Weekly, 1979, 4(47), 47, 48-52.

Describes the raw material availability for polymer industry in India. Highlights how and in what areas the Indian market was developed to utilise polymers for various applications (MSR)

LEATHER INDUSTRY

446. GIORDANO J.J.: Maintenance of drying, dust removal and finishing equipment. The Leather Manufacturer, 1979, 97(11), 30-33.

Discusses the maintenance which relates to general upgrading of equipment and the maintenance problems specifically related to drying, dust removal and finishing equipment. (BS)

447. JUDD B.: Leather fillers. The Leather Manufacturer, 1979, 97(11), 20-28.

Brings out various roles of fillers in leather making and enumerates different fillers used for specific purposes. (BS)

448. KLUGAR J.: Leather finishing: Two decades in review. Leather & Shoes, 1979, 172(9), 44-48.

Analyses leather finishing advancements since 1959 based on the experience of a consultant in the field. (BS)

449. SELVARAGAN R.: Scope for the leather industry. Leather Markets, 1979, (February), 21-31.

Reviews the present status of the leather industry including government policy and examines the scope for further development in raw materials, production of leather and leather goods and leather chemicals and fabrication of equipment. (BS)

MINERAL BASED INDUSTRIES

Glass and Ceramics

450. ----: Materials for electronic/industrial and newer ceramics. Ceramic Industry, 1979 (January), 25-39.

Enumerates the properties and applications of different ceramic materials useful in electronic/industrial and newer ceramics. (BS)

451. CHATTERJEE R.N.: Ceramics in electronic devices. Indian Ceramics, 1979, 21(12), 317-320.

Discusses the contribution of ceramics as insulators in high voltage electrical and electronic devices and as ferrites for electronic circuits and devices. (BS)

452. DHARIYAL K.D. & MOHAN A.J.: Calcium silicate bonded asbestos insulation products. Research and Industry, 1979, 24(1), 90-101.

The aim of the present investigation was to assess the suitability of locally available amphibole asbestos of anthophyllite variety for making light weight thermal and fire resistant products. The results obtained indicate that anthophyllite and tremolite varieties of asbestos fibres are suitable for use in the production of lightweight insulation products.

453. DWIVEDI R.N. & NATH P.: Some special glasses. Glass Udyog, 1979, 8(2), 13-18.

Highlights the characteristics and uses of photo-sensitive glasses, photochromic glasses, infra-red filter glasses, infra-red transmitting glass and heat absorbing glasses. (BS)

454. PATRICK M.C.: Chemicals and minerals in glassy systems. Indian Ceramics, 1979, 22(9), 249-252.

Gives the properties of glassy materials and enumerates the compositions of glass, enamel and glaze. (BS)

455. PICK A.N.: Properties and applications of silicon carbide refractories. Transactions and Journal of the British Ceramic Society, 1979, 78(4), 13-15.

MECHANICAL ENGINEERING

456. ----: Anila-1: Low cost windmill for pumping water. Invention Intelligence, 1980, 15(1), 17-23.

Anila-1 is a horizontal shaft, sailing type windmill of an entirely new design, particularly suitable for coastal locations. It can be fabricated from local materials, by local artisans, at an estimated cost of ₹ 1,500 (materials, including simple plunger pump ₹ 1,100; construction and installation, ₹ 400). The components required for construction are described.

457. ----: A study on market for steel wire rods. Industrial Researcher, 1979, 6(3), 173-185.
Presents a market analysis and reviews production, import/export, growth and present status, problems of industry, and future demand supply position. (JBS)
458. ----: Directory of worldwide engineering and construction firms - a special advertising supplement. Chemical Week, 1979, 1(4), 31-67.
For each of the companies listed, information relating to their world-wide offices, details of the company, the names of officers, capabilities, recent projects undertaken and the clientele is given. (JBS)
459. KUTE M.B. & MUPID N.S.: A new internal groove milling attachment. Invention Intelligence, 1979, 14(5), 181-182.
The new attachment for universal/vertical milling machines enables precision machining of internal grooves, both straight and helical on a job. (AA)
460. SHEPPARD W.F.: Designing a small-plant preventive maintenance programme. Plant Engineering, 1979, 33(3) 119-121.
Describes the various points to be considered while designing a preventive maintenance data processing system. (SS)
461. WAIBLINGER P.K.: Springs and their manufacture. Wire Industry, 1979, 46(546), 413-416.
A synopsis of the main aspects of spring manufacture from a brief historical background to a more detailed description of the contemporary scene is given. The various coiling principles for automatic production of springs are explained, and a short description is given of some of the different types of equipment offered. Integrated quality control is now becoming more and more important and reference is made to the electronic spring length measuring, monitoring and sorting units now available. The influence of tempering, scragging, shot peening, and corrosion protection for springs is referred to as well as spring end grinding.

METALLURGICAL INDUSTRIES

462. ----: Ferro silicon: A demand analysis. Industrial Researcher, 1979, 6(2), 117-123.

463. ---: It can pay to tune up the brass section.
Machinery and Production Engineering, 1979, 134(3448)
35-38.

Describes the techniques of hot stamping and two types of pressure die casting, each having distinct advantages, for making a range of brass products. (KLR)

464. ABRAHAM K.P.: ESR towards purer steels and alloys.
Science Today, 1979, 13(10), 17-22.

Discusses the principles and technology of electroslag refining for metallurgical industries.

465. MUKHOPADHYAY A.K et al: Metallurgical aspects of wire patenting. Tool & Alloy Steels, 1979, 13(8&9) 263-268.

Patenting is a heat treatment applied to steel rods and wires of medium to high carbon content to obtain a fine pearlitic microstructure. This imparts to the wire the ability to withstand heavy cold deformation to produce the desired finished sizes having high tensile strength and good toughness. The metallurgical aspects during patenting in regard to various parameters such as material composition, furnace temperature, lead bath temperature, wire speed and other related aspects are discussed. (MVS)

ELECTRICAL INDUSTRIES

466. MANJUNATHAN K.V.: Some factors influencing the solution of standby diesel generators. Electrical India, 1979, 19(17), 5-10.

Need for standby power supply, factors to be considered for selection of generating set, protection of the generating set etc., are mentioned. (LKPC)

467. MISRA S.N.: Power transformers. URJA, 1980, 7(3), 113-114.

Transmission and distribution losses could be reduced by better power and distribution transformers

468. NARAYANA RAO M: et al: Design, fabrication and testing of load cell for measurement of force in wire drawing process. Machine Building Industry, 1979, 18(5), 3-6.

The measurement of force during wire drawing for different drawing conditions, require a device well suited for laboratory work and also in industry. A test rig using a speed control unit consisting of a D.C. motor, connected to A.C. mains through a rectifier circuit is designed and fabricated. The motor is coupled to the capstan of the wire drawing unit. A hollow cylindrical type load cell is designed and

fabr fabricated for the measurement of drawing force incorporating resistance strain gauges. The complete unit is calibrated against a bridge circuit. The details of the force measurement unit including calibration are given. The unit can be installed on wire drawing machine to determine the drawing force at different drawing conditions.

469. PHADKE G.M.: Review of electrical industry. Electrical India, 1980, 20(2), 5-11.

Reviews the role of electrical industry in supporting the power development programme. (MVS)

ELECTRONICS INDUSTRIES

470. ----: Economical IC stereo amplifier. Electronic Application News, 1979, 16(1&2), 43,47.

Gives a design of medium power stereoamplifier that uses TDA 1011, a monolithic integrated class B audio amplifier in 9-leads single inline plastic package SOT 110 A. (AA)

471. MORRIS N.M.: Memory circuits. Electronic Design, 1979, 2(9&10) 15,20.

Explains various types of memories such as static & dynamic memories, S-R flipflops, masterslave flip-flops master-slave j-k flip-flop and other types of flip-flops, RAM's, ROM's, CAM's etc. (VVR)

472. OHR S.: Focus on capacitors - Performance changes with improved dielectronics in small packages. Electronic Design, 1980, 28(5), 119-125.

Explains broadly about capacitor types, including computer-grade electrolytics, multilayered ceramic films and solid tantalums and gives their application, advantages and disadvantages. (VVR)

473. OSWALDK D.E.J.: Thyristors: Status of technologies. Electronic Progress, 1979, 21(1), 30-32.

Highlights the possibilities of today's device technology with emphasis on the lower power portion of the power spectrum, often neglected in technical journals. Five layer devices, such as Triacs, are also available, using the same processes as for the four layer devices. A brief outlook into the future is given.

474. SARNOT S.L.: Status and perspective of the electronic components industry in India. Electronics - Information & Planning, 1979, 6(9), 759-782.

Reviews critically the growth of the components industry with special reference to the period 1971 to 1978 and investigates the future role the industry is expected to play. (MVS)

475. SUBRAMANIAN C.R.: Commercial and technical aspects of ICs development and production. Electronics - Information & Planning, 1979, 6(9), 783-794.

Surveys the technical and commercial aspects of ICS development and production all over the world. Portrays the Indian scenario with special reference to the ICS development programme at Bharat Electronics Limited, Bangalore. (MVS)

SENDOC Services

Featured in this section are technical enquiries that were received and the services rendered by SENDOC during the month of August 1980. The charges for short technical enquiries will be ₹ 5.00 to ₹ 10.00 per typed page. Industry profiles already available with SENDOC are charged at the rate of ₹ 10.00 each.

Sl.No.	Enquirer	Service Rendered
1.	DIC, Raipur, Madhya Pradesh	Profile on: Forging shop
2.	DIC, Mizoram	Profiles on: Jawacithonella grass oil, Absorbent cotton
3.	Ent. Andhra Pradesh	Profiles on: Calcium carbonate, Structural fabrication, Rigid PVC pipes/fittings, Ice plant, Fruits processing, Printing press
4.	Ent. Bihar	Profile on: GLS lamps
5.	Ent. Gujarat	Profiles on: Ginger oil, Oleoresin from ginger and chillies
6.	Ent. Karnataka	Profiles on: Drink tablets, Mosaic tiles
7.	Ent. Kerala	Profile on: Absorbent cotton
8.	Ent. Madhya Pradesh	Profile on: Latex foam
9.	Ent. Maharashtra	Profiles on: Ferric chloride, Alcohol, Ice plant, Cardboards
10.	Ent. Orissa	Profile on: FHP motors
11.	Ent. Tamil Nadu	Profile on: Paper tubes
12.	Ent. Uttar Pradesh	Profile on: Printing press
13.	FI. Orissa	Profile on: Nuxvomica alkaloids
14.	GD. Tamil Nadu	Profile on: Bleaching powder

Sl.No.	Enquirer	Service Rendered
15.	IC. Andhra Pradesh	Profiles on: Pressure die casting, Typewriter ribbon, Carbon paper
16.	IC. Gujarat	Profile on: Cattle feed
17.	SI. Andhra Pradesh	Profiles on: Banana powder, Ferric alum, Welded mesh, Laminated jute bags, Room coolers, Barbed wire, Steel wire drawing
18.	SI. Bihar	Profiles on: Absolute alcohol, Solvent extraction plant, Rice bran oil, Engine valves
19.	SI. Gujarat	Profiles on: Potato chips, Potato wafers, Potato starch
20.	SI. Karnataka	Profile on: Dry cell battery
21.	SI. Madhya Pradesh	Profiles on: Doors and windows, Oxalic acid from saw dust, Saw dust briquetting, Calcium carbonate, Hydrated lime, Wire nails, Citric acid
22.	SI. Maharashtra	Profile on: Flooring tiles, Stoneware pipes, Iron clad, Switches, Dairy farm, Steel furniture
23.	SI. New Delhi	List of manufacturers of: Air-conditioning and refrigeration appliances
24.	SI. Orissa	Profiles on: Tarpaulins, Glass containers/articles, PVC cables, PVC wires
25.	SI. Tamil Nadu	Profiles on: Welding electrodes, Rubber reclaiming unit, Latex foam, Carbon black, Automobile rubber components
26.	SI. West Bengal	Profiles on: Coconut oil, Steel rerolling mill, Aluminium rerolling mill, Biscuit and bakery industry, Bicycle tubes and tyres, Aluminium cables, Basic dyes, Bleaching powder, Industrial alcohol, Ferric alum, Barely malt extraction.

Note: DIC - District Industries Centre, Ent. - Entrepreneur
FI. - Financial Institution, GD - Government Department
IC. - Industrial Consultant, SI - Small Industry.

New Products and Processes

CHEMICAL INDUSTRIES

Calcium Silicide

The Central Electrochemical Research Institute (CECRI), Karaikudi, has developed a process for the production of calcium silicide. The process consists in mixing calcium oxide, ferrosilicon and calcium chloride in definite proportions. The mixture is then fed into a water-cooled arc furnace equipped with three graphite electrodes arranged in a triangular set-up. On completion of the melting of charge in the course of 3-3.5 hours, sufficient cooling time is given before the product and slag are removed. The product is then analysed for its quality.

Calcium silicide finds application as a deoxidizing and desulphurizing agent in the iron and steel industry, and for the production of smokescreen, ignitors for tracer projectiles, etc. in defence. Besides its application as a primer for explosives and as an inoculant in the production of mechanite casting, it is used in the production of nodular cast and heat resisting cast from alloys. Calcium silicate slag obtained as a by-product finds application as a filler in road construction. It is also used in heat insulating.

Calcium silicide is not known to be produced in the country and the entire indigenous requirement is met by imports: 161 tonnes of calcium silicide were imported during 1976-77 at a cost of Rs. 17.56 lakhs. In view of the increase in the production of iron and steel and the corresponding development of iron and steel casting industry, the demand for calcium silicide is likely to grow.

CECRI has studied the process on 27-30 kg/batch scale with an operating duration of 3-3.5 hours.

Calcium oxide, ferrosilicon and calcium chloride are the main raw materials required. All these are available indigenously. The items of plant and machinery required in the process are: furnace transformer (650 KVA), choke (iron cored, air cooled), capacitors, tap changer, furnace shell, bogies, electrode motor pumps, jaw crusher, screens and grizzly.

The suggested capacity of an economic unit is 100 tonnes of calcium silicide per annum. The total investment to put up such a unit is estimated at Rs. 12.41 lakhs (fixed capital, Rs. 7.41 lakhs; and working capital Rs. 5.00 lakhs).

The cost of production works out to be Rs. 16/kg.

Ethanol from Sucrose-rich Crops (EX-FERM)

The Central American Research Institute for Industry (Guatemala) has developed at the laboratory level a new technology to transform sucrose-rich materials such as sugar-cane or sweet sorghum into ethanol.

In the EX-FERM process, cane from the fields is cleaned and cut and reduced to small chips. These are placed in a fermenter together with water and yeast. The sucrose is extracted from the cane and is simultaneously fermented using the same equipment. Once fermentation is completed the chips are separated and the solution is used again with a batch of fresh chips. After fermentation, the solids are separated and stripped of entrapped residual ethanol, and the liquids are passed on to the distillation column where they are stripped of ethanol using a standard technique. Some of the cane chips could be dried and stored and could be processed when there is no cane harvest.

The basic differences between the normal process and the EX-FERM are that the latter:

- a. Does not extract juice from the cane in a mill;
- b. Does not ferment the juice separately;
- c. Extracts and ferments the sucrose in the cane in one operation;
- d. Can operate year-round. Chips can be dried and stored without affecting fermentation.

By carrying out sucrose extraction and fermentation in one operation, a saving is possible in the equipment needed for juice extraction. Moreover, the size of the electricity supply plant can be reduced as most of the energy used in the normal process is used in the juice extraction mill. In the EX-FERM process more than 99 percent of the original sucrose present in the cane is converted into ethanol, giving almost 10 percent more ethanol than with the standard technology.

Costs would vary from country to country and the methodologies employed can also vary. However, most of the available data show that fixed investment costs for independent distilleries with annual capacities of between 35 million and 300 million litres range from 0.13 to \$ 0.52 per litre per year. Production costs are between \$ 0.21 and \$ 0.26 per litre, operating 180 days with cane costing \$ 10 to \$ 12 per tonne and 120 days, with molasses costing \$ 26 to \$ 53 per cubic metre.

The production cost breakdown in tropical countries shows that raw materials, nutrients, depreciation and interest on capital account for more than 94 percent of the total cost. Moreover, more than 50 percent of fixed investment is for equipment for cane preparation, juice extraction and plant utilities.

For further information contact: Central American Research Institute for Industry, Avenida La Reforma 4-47, Zone 10, Guatemala.

Zinc Phosphate Pigment

The use of zinc phosphate as anticorrosive pigment has been established in the West. It is not widely used in our country. Zinc phosphate pigment can be used for the preparation of anti-corrosive primers for ferrous metals. Zinc phosphate reduces the diffusion rate of corrosive ions through paint film and slowly phosphates the metal surfaces. Zinc phosphate in primers promotes excellent intercoat adhesion, particularly under condition of high humidity. Zinc phosphate is not toxic.

Zinc oxide or zinc carbonate is slurried with water and added to stoichiometric quantity of suitably diluted orthophosphoric acid. Constant stirring is maintained during the addition. Zinc phosphate formed is filtered and washed in a centrifuge. It conforms to the specification B.S. 5193.

The process has been studied on a laboratory scale at the Central Electrochemical Research Institute, Karaikudi, Tamil Nadu on 10 kg. batches. The primer prepared using the zinc phosphate was evaluated by electrochemical accelerate and field tests and the performance was found to be satisfactory.

Zinc oxide/zinc carbonate and orthophosphoric acid are the main raw materials. All are available indigenously. All the equipments are available in the country.

The total investment for putting up a plant capable of producing 300 tonnes of product per year has been estimated at Rs. 19.04 lakhs.

Building	Rented
Fixed Capital on equipment and erection charges	Rs. 4,51,450/-
Working Capital for 90 days	Rs. 14,53,500/-
Total Investment	Rs. 19,04,950/-
Cost of Production per kg.	Rs. 18.50

ELECTRONICS AND ELECTRICAL INDUSTRIES

Electrically Conducting Fluidised Beds

Investigations into the conductive properties of fluidised beds of metal particles by Professor E J Davies of the Department of Electrical Engineering at the University of Aston in Birmingham have revealed a number of potential industrial applications. Such a bed can function as a quasi-liquid, non-wetting contact and can be used to conduct substantial currents to a stationary electrode or a moving part.

It has been known for some time that fluidised beds of carbon particles conduct electricity and can be heated electrically using this property. Carbon particles, however, have a tendency to form themselves into needles owing to localised overheating because of their negative temperature coefficient of resistance. Metallic particles are theoretically highly satisfactory but tend to form a non-conducting oxide coating. Professor Davies has devised methods for overcoming this problem of oxide formation and has demonstrated the practical benefits of such an arrangement, using copper particles around 200 μm in diameter.

The copper particles are initially deoxidised by electrolysis, pickling and washing, or by the passage of a reducing gas (hydrogen or a hydrogen/nitrogen mixture). They are transferred into the bed in an inert atmosphere, and the bed is then fluidised using nitrogen or forming gas (a mixture of nitrogen and hydrogen). If nitrogen is used, the periodic introduction of small amounts of hydrogen into the fluidising gas serves to keep the particles clear of any incipient oxide deposit.

So far, a deoxidised copper bed has been made to conduct 9.5 KA - the highest current presently available from a particular University transformer - and it is believed this is well below the ultimate limit of the fluidised-bed part of the system. The voltage drop across the bed is low - typically 0.6 V.

In general terms, the metallic fluidised bed appears to be relevant to the following requirements:

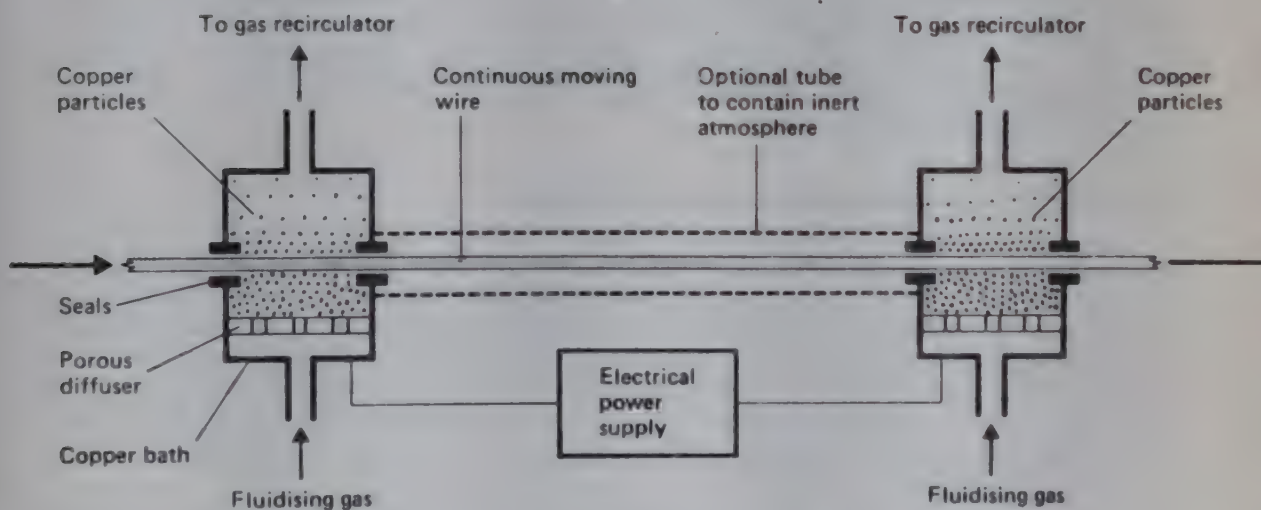
- Conveying electrical current to a moving component
- Resistance heating a moving (or static) component
- Forming a switch by moving a rod in and out of the bed to make and break a circuit.

More specifically, the following practical industrial applications have so far received attention:

Annealing continuous wire or strip

Conventionally, continuous wire is resistance heated by running it from one copper drum to another and feeding current into the drums. This method suffers the disadvantage of surface marking of the wire and damage due to arcing. One alternative is to use a furnace, which has high capital cost and is wasteful of energy.

The diagram shows an experimental model that has been constructed and has demonstrated the technical feasibility of using a fluidised-bed system for the resistance heating of wire. Each fluidised-bed copper bath is quite small (300 mm x 12 mm x 50 mm deep). 1 mm diameter steel wire passing through the baths at a rate of 0.75 m/s has been heated to annealing temperature (800°C) in the active length of 1 metre using a current of 80 A at 30 V. Between the beds, the wire may be passed through a tube filled with inert gas; this prevents surface contamination of the wire. The bed at the 'hot' end is water cooled.



Fluidised-bed system for resistance-heating continuous wire or strip

Electrode connections in arc furnaces

Conventionally, current is fed to the electrodes in an arc furnace by using massive and expensive, flexible, water-cooled cables that require periodic replacement. This arrangement could be eliminated by taking advantage of the sliding contact offered by using a fluidised metallic bed to form the connection to the electrode together with a separate, off-load, fluidised-bed switch which isolates the electrodes during tilting.

Resistance heating of large metal billets

The conventional method of making connections to resistance-heat billets involves complicated water-cooled electrical clamps that are expensive and tend to mark the billet. A pair of fluidised beds is able to convey heavy currents to the billet without damaging its surface provided that the temperature of the billet is not greater than the melting point of the bed particles.

Experimental work on high-current beds is continuing at Aston and Professor Davies is keen to discuss practical applications. The prototype wire-annealing rig can be demonstrated to manufacturers with serious interest in the process. Initial enquiries from potential licensees should be directed to Peter Thompson, Computers, Systems and Electronics Group, NRDC, Kingsgate House, 66-74 Victoria Street, London who is responsible for commercial arrangements and can arrange the appropriate introductions. The invention is the subject of a European patent application.

Fast Response Electronic Thermometer

A fast response electronic thermometer having a high degree of repeatability, has been developed at the National Aeronautical Laboratory (NAL), Bangalore for industrial use. Besides temperature monitoring, it finds use in process control applications as the output is an electrical parameter voltage. Such types of thermometers could also be used in aircrafts for measuring outside air temperature, and also on masts for measuring atmospheric temperature.

The electronic thermometer consists of a sensing element a chromel/alumel thermocouple of 30 SWG. The sensing junction could be as far away as 50 feet from the instrument. Cold junction compensation has been provided by placing the reference junction in a temperature controlled oven specially designed for the purpose and can be accommodated within the same chassis as the thermocouple amplifier. An ultra-low drift precision op-amp has been used to amplify the thermocouple signal to the required level of 5V full-scale to read 150°C. The instrument operates straight from the a.c. mains, having a built-in, regulated power supply.

The novel feature of this thermometer is that it requires calibration only once in two years. While it takes about a minute for the mercury-in-glass thermometer to record the temperature, the electronic thermometer requires less than a second.

The instrument has been tested by the Systems Engineering Division, to evaluate its performance. The experimental results obtained hitherto after intensive use of the unit in temperature monitoring have indicated its satisfactory functioning

Considering the performance, such type of thermometers are relatively inexpensive and easy to construct.

Specifications

Range	0-150°C
Accuracy	$\pm 1^\circ\text{C}$
Response time	$\frac{1}{2}$ sec.
Reference temperature	75°C
Full scale output	5V (Pre-adjustable to any value from 150mV to 5V)
Power requirement	Mains 230V, 50Hz, 20W
Dimensions	
i.	8" X 6" X 11"
ii.	750 gms. (approximately)

Temperature Indicator

Developed by the Central Scientific Instruments Organisation (CSIO), Chandigarh, the digital temperature indicator indicates the temperature, measured by its sensors, in the form of numerals. This makes the measurements convenient, easy and accurate. CSIO has fabricated three prototypes whose performance has been found to be satisfactory.

The CSIO indicator can be used over a wide range from minus 200 degrees C to + 1760 degrees C. The indicator employs the following four sensors for different temperature ranges: platinum-platinum/rhodium thermocouple for + 200 degrees C to + 1760 degrees C; chromel-alumel thermocouple for + 10 degrees C to + 1200 degrees C; RTD-46 for minus 200 degrees C to + 500 degrees C; and RTD-100 for minus 200 degrees C to + 650 degrees C.

The design of the instrument is based on integrated circuit technology and it is completely modular in nature. Each sensor is associated with a separate cord so that its replacement is easy. Any of the linearisation modules along with the common integral unit makes a complete digital temperature indicator with the particular sensor. Depending on the requirement, a user may make his indicator with one sensor or up to four sensors.

The specifications of the indicator are as follows:

Temp. range: minus 200 degrees to plus 1760 degrees C; Resolution 1 degree C; Accuracy: 0.5 percent full scale; Display: 3- $\frac{1}{2}$ digit LED.

The following equipment is required for the manufacture of the instrument: oscilloscope, pulse generator, power supplies, stabiliser, avometer, variac, digital multimeter and digital LCR meter. The last two will have to be imported; the others are available indigenously.

ICs, LED display, transistors, diodes, zeners, resistors, capacitors, potentiometers, transformers, PCBs, switches and other hardware items are the components required. All are available indigenously, though ICs and LEDs are of imported origin.

For the manufacture of 300 pieces of the indicator per annum, a fixed capital (excluding land and building) of Rs. 0.75 lakh, and a working capital of Rs. 1.5 lakhs are needed.

The terms for transfer of know-how are: lump sum premium, Rs. 10,000; recurring royalty, 2 $\frac{1}{2}$ percent, nature of licence, non-exclusive; and period of licence, five years.

ENGINEERING INDUSTRIES

Coulter System for Direct Drilling

Dr. D. MacIntyre and Dr. M. J. Butson of the Scottish Institute of Agricultural Engineering (SIAE) have developed a novel soil-opener system for use in the direct drilling of uncultivated ground.

The amount of cereal and other crops sown by direct drilling in the UK has increased substantially in recent years. The soil is generally opened by discs or tines, both of which have disadvantages on uncultivated ground. Discs need extra weight to achieve adequate penetration and can also smear the sides of the slit into which the seed is planted, encouraging predators and impeding root growth. Tines cannot easily penetrate surface trash, and frequent blockages occur.

The system developed at SIAE uses a single disc to cut through trash and form a vertical slit in the soil. An A-blade coulter with angled wings follows behind the disc, lifting the surface soil to either side of the slit and forming transverse cavities beneath the ground. Seed is distributed pneumatically towards the extremities of these cavities through delivery pipes within

each wing, and the soil falls down to close the cavities once the trailing edges of the wings have passed. A light roller, following behind the A-blade, firms the soil down and also controls the depth of penetration. The result is two rows of seed, each sown at a depth of around 3 cm and about 10 cm to either side of the central slit, in a favourable environment for germination and establishment.

The advantages of the SIAE system compared to conventional disc or tine drills are:

- Each coulter unit plants two rows of seed, halving the number of units needed in a drill.
- The seed is placed away from the central slit and any smeared soil, aiding establishment.
- The seed is completely covered and thus protected from predators.
- The undisturbed covering retains moisture in the soil around the seed, aiding germination.
- The leading disc cuts through surface trash and prevents time-consuming blockages.
- The angled wings pull the coulter into the soil without needing weight to be added to the drill.
- Fertiliser can be placed through the blade of the coulter into the central slit, away from seed.
- The roller following the coulter ensures accurate depth control on uneven ground.
- The A-blade coulter is self-sharpening, robust, simple and cheap to construct.

Following encouraging results with a first prototype, SIAE has recently completed the construction of an improved machine that will be used for field trials at a number of sites during 1979. The drill will be demonstrated at Open Days to be held at the ARC's Letcombe Laboratory at Wantage (22-24 May) and at SIAE (6-7 June).

Companies interested in manufacturing and marketing soil openers or drills of this type under licence are invited to contact Lewis Wilson, Mechanical and Civil Engineering Group, NRDC, Kingsgate House, 66-74, Victoria Street, London.

Simple Fluid-Jet Attenuator

Mr. J.E. Rapson of Hovercraft Development Ltd has found that a tailpipe of conical profile fitted to the outlet of a pipe carrying a liquid or gas at high pressure can be made to attenuate the force of the emerging jet of fluid.

The attenuation effect is associated with the formation of intensively active vortices within the fluid in the conical section and therefore depends on the shape of the cone. For a liquid, the cone easily can be kept full of liquid by placing an obstruction such as a perforated grid across the mouth of the cone. The device works even when the jet is mounted horizontally or vertically downwards. If the cone is empty there is no attenuation. There is little difference in resistance to flow between the two modes, and thus it is possible to switch the jet on and off without restricting the rate of flow through the system.

The device could be used in a number of roles:

- to reduce the 'throw' of a fluid jet
- to reduce the reaction of the jet on the pipe
- to reduce the pressure of a piped fluid
- as a heat exchanger
- to mix fluids
- to separate gases from liquids

While devices for achieving these effects already exist, Mr. Rapson's design is extremely simple, cheap, compact and has no moving parts. Although cones of various cross-sectional shapes have been used, the angle of the cone must be kept within defined limits if the desired effects are to be obtained.

The intensity, size and position of the vortices may be varied by altering the geometry of the cone, either at the design stage or by making the cone adjustable - a feature that can be used to advantage in mixing, separation and heat-exchange applications.

The conical attenuator could have numerous applications in a broad range of industries. One of the simplest is reducing the disturbance when filling a liquid storage tank containing sediment. At the other extreme the principle could be applied to district water supply installations or be used to contain and collect the products of an oil-well blow-out.

Patent protection has been sought in the UK, Canada, France, West Germany, Japan, the Netherlands, Norway and the USA.

Companies interested in using or manufacturing devices based on this principle are invited to contact David Veasey, Mechanical & Civil Engineering Group, NRDC, Kingsgate House, 66-74, Victoria Street, London, information and to discuss licensing arrangements. Financial support might be available for UK companies wishing to develop the more important applications.

FOOD AND ALLIED INDUSTRIES

Fish Meal and Oil from Sardines

Fish meal is an important constituent of livestock and poultry feeds. Fish oil has several potential uses. After suitable processing, it can be used in leather processing, paints, surface coating and printing inks industry. Deodourized oil is used in the manufacture of soaps, detergents, cosmetics and in canning of fish.

About 20,000 tonnes of fish meal and 8,000 tonnes of fish oil are presently being produced in the country by traditional methods. Most of the fish meal is used as manure and fish oil for painting wooden boats. Fish meal, by virtue of its utility has good demand in international market. The market price of fish meal (of 58-60% protein content) varies between Rs. 2,200 and 3,000/tonne and that of fish oil (with a maximum acid value of 5.0) between Rs. 5,000 and 7,500/tonne.

The technique adopted at the Central Food Technological Research Institute (CFTRI) Mysore, is an improvement over the traditional practice and involves continuous wet reduction, which improves the product quality. Raw fish washed free of sand is fed into a continuous steam jacketed conveyor-cum-cooker. The cooked fish is screw pressed. The pressed cake is pneumatically dried, milled in a hammer mill and packed. The liquid obtained at the pressing stage is screened to remove the stick water solids and allowed to settle for the separation of oil by overflow. The oil collected is washed, centrifuged and transferred to barrels. The products obtained conform to Indian standards specifications for fish meal and fish oil.

The main raw materials, sardine fish and commercial fuel oil (LDO/furnace oil), are available indigenously.

The main equipment such as conveyor with washing system, cooker, screw press, press cake disintegrator, pneumatic drier, hammer mill, centrifuge, boiler etc. can be procured indigenously from equipment manufacturers/suppliers or fabricated.

Pre-design cost data (Basis 30 tonnes of fish/day)

Land and Building	Rs. 1.53 lakh
Plant and Machinery	Rs. 8.76 lakh
Working Capital	Rs. 4.46 lakh
Cost of Production	Rs. 450 (processing cost per tonne of raw material).

Studies were carried out at the pilot plant set up at CFTRI Fish Technology Experiment Station at Mangalore, having a capacity of 8-10 tonnes raw material per day, and consistent

results were obtained for three consecutive fish seasons. Scale-up data for commercial units are available. The institute can provide consultancy service for setting up complete plants.

Vinegar from Pineapple Waste

The total area under pineapple in India is about 10,000 hectares and nearly 65,000 cases of pineapple products prepared from 2,500 tonnes of fruit are manufactured annually. Mainly due to inadequate utilization of cannery waste, the industry has not progressed much during the last two decades. On account of the oval and uneven shape and size of Indian fruits, peels, cores and pomace account for 40-50% and cannery waste constitutes about 60% as against 35% in Hawaii. In Hawaii, syrup, bromelain enzyme, citric acid, cattlefeed etc., are prepared from the cannery waste. On the other hand, in India, not only is the waste not made use of, but a cannery processing 20 tonnes of pineapples spends Rs. 50 per day on waste disposal. Profitable utilization of the waste will reduce the cost of the main products considerably and thus help the development of the pineapple processing industry on a sound economic footing.

These waste materials contain considerable quantity of sugar (7-10%) and the manufacture of vinegar appears to be a better proposition for utilizing the same.

The Central Food Technological Research Institute (CFTRI), Mysore has produced good quality vinegar from pineapple peels which are considered a waste material. The method as standardized consists in passing the peels through a pineapple crusher, extracting the juice in a hydraulic press with 60% recovery, fermenting the juice with *Sachharomyces cerevisiae* after adjusting the final Brix to 10 and then passing the alcoholic fermented juice through a wooden generator for acetic acid fermentation with *Acetobacter* culture. Alcoholic fermentation takes 4 days and acetic fermentation, another 4 days, to convert 400 kgs. peel juice into vinegar. By adopting this method of utilizing the waste products in a pineapple canning factory, on an average, an additional profit of Rs. 40,000 is possible.

New Machinery and Equipment

AGRICULTURAL MACHINERY

Cattle Feeder

What is claimed to be the only automatic cattle feeder that ensures that only the animal selected can get at its feed has been developed by one of Britain's leading manufacturers of dairy equipment.

The Feedamatic, designed for feeding concentrates to selected cattle within a herd, is particularly suitable for use with loose-housed animals and should be positioned in such areas as the exercise yard or near the cubicle housing.

Its special feature is that the feeder mechanism can be activated only by the metal links attached to a plastics chain placed around an animal's neck. A tubular rail stall protects the feeding cow from non-selected members of the herd, and the stall's rear gate closes automatically once the selected animal is in position. In this way, only cows wearing the special chains are fed from the automatic feeder. When the animal has finished eating and steps backwards from the manger, the rear gate opens automatically.

The metal links on the animal's chain, when placed near a detector on the front of the manger, activate the feeder mechanism to dispense a pre-determined amount of concentrates - usually 250-700 g - into the manger pan. A control at the back of the unit can be used to vary the amount of concentrates. After each activation, a relay prevents reactivation of the feed mechanism for a pre-set period.

A built-in storage hopper holds about 260 kg. of concentrates which are transferred into the manger pan by a vibratory mechanism, operated by a low-voltage electricity supply.

Overall length of the equipment is 4.2 m with the rear gate open and 3.8 m with the gate closed; the width is 845 mm and height to the top of the hopper is 1.55 m.

Developed from on-the-farm investigation, the feeder gained the 1977 Royal Agricultural Society of England's Gold Medal - Britain's highest and most important agricultural award.

Manufacturers: R.J. Fullwood & Bland Ltd., Ellesmere, Salop, England.

Disc Harrows

Two trailed disc harrows to withstand arduous working conditions have been introduced by one of the Britain's leading manufacturers of agricultural machinery.

Both the D7 models are equipped with 560-mm-diameter discs of extra-tough, hot-treated steel that resists bending, chipping and breaking under even the toughest conditions. Plain or scalloped discs are offered and there is a choice between a 28-disc and a 32-disc version, both with heavy-duty carriers and disc frames of square tubular steel to withstand shock loads. Discs are spaced at about 230 mm and shift size is 30 mm.

A telescoping hitch stabiliser enables the harrows to effect better penetration than on previous models as well as giving wide operational flexibility. A special compensating spring ensures a level bed even in rough ground and prevents the front and back gangs from going in and out of the ground. Should the harrow strike a rock or other hard obstacle, the spring permits the disc to rise and clear the obstruction and then return to the correct discing depth.

A stabiliser locking pin secures the unit for transport, and the hitch can easily be adjusted for high or low tractor draw-bars.

Working width is nearly 3 m (9 ft. 9 in.) for the 28 disc unit and almost 3.5 m (11 ft. 3 in.) for the 32-disc version. Approximate weights of the harrows are 1,000 kg and 1,040 kg. respectively.

Manufacturers: Bamfords Ltd., Uttoxeter, Staffordshire, England.

Agents: British Engineering Co., 105 Apollow Street, Fort, Bombay.

Grain Driers

Easily-erected, low-cost grain-drying and storage silos constructed of steel mesh and hessian, which have been introduced by a British firm, are available in four sizes upto a capacity of 60 tonnes and can be dismantled and rolled up when not in use.

The Gray Grain system, for use under cover, has been designed to provide drying and storage units at a fraction of the cost of conventional systems.

Using air at ambient temperature, each size of silo will dry grain and other material down from 22 percent, moisture content to 16 percent in from 10 to 21 days, depending on humidity conditions.

A complete unit consists of one or more of the cylindrical, stainless-lined silos, which are open at the top and bottom and are fitted with a vertical central tube and an unloading hatch or hatches.

One high volume electrically driven axial fan, which is mounted on top of each silo in turn, dries the grain by sucking large quantities of air through the central tube. One fan will serve upto three silos.

This system makes full use of the drying properties of the ambient air, and because of the partial vacuum created at the bottom of the central tube, ensures an even flow of air over the grain.

The driers are supplied as packaged parts and are easily erected by unskilled labour. Two men can erect three 20-tonnes-capacity silos in about five hours.

The sizes of the silos available range from the Junior, a 9-tonne-capacity unit which has a height of 2.54 m (8 ft. 4 in.) and a diameter of 2.44 m (8 ft.), to the Jumbo which will hold 60 tonnes of grain and is 3.55 m high (11 ft. 8 in.) with a diameter of 5.48 m (18 ft).

All the silos are fully adjustable for height and diameter within these measurements. For each model, a PVC silo lid is available for use in high humidity and cold situations. They protect the surface of the grain and increase the airflow through it and reduce uneven drying. The units are designed for a minimum life of 10 years.

In addition to drying and storing grain, the silos are suitable for these functions with beans, peas, onions, oil-seed rape, hay bales and other produce.

Manufacturers: Gray Grain Ltd., Brownlow Street, Stamford, Lincolnshire, England.

ELECTRONICS AND ELECTRICAL EQUIPMENT

Function Generator

A choice of sine, triangular and square waves with positive or negative pulses is provided by an economic function generator introduced by Philips Test & Measuring Instruments. The PM 5132 provides an output of 30 V peak to peak 15 V peak to peak for pulses, from 0.1 to Hz to 2 MHz.

The output duty cycle can be varied from 10 to 90 percent and the output attenuated in steps or continuously up to 80 dB. DC offset from - 10 to + 10 V is provided for all functions. Internal and external linear sweeps are standard and there is a TTL output.

Short circuit proof output: Seven overlapping frequency sub-ranges are provided covering the complete 0.1 Hz to 2 MHz range. Frequency setting is linear with a dial giving a setting accuracy of plus and minus 2 percent of the maximum sub-range frequency. A vernier allows frequency adjustments of plus and minus 5 percent.

The output impedance is switchable for 50 or 600 ohms and the output is shortcircuit proof. A separate fixed level TTL output is provided with the same duty cycles as the main output.

Varied sweep facilities: The internal or external sweep ranges can be set for a maximum of two-and-a-half decades. Sweep times can be selected continuously between 50 ms and 100 ms. Continuous or single sweep are possible with maximum sweep frequency around 15 kHz.

The sweep start frequency is fully adjustable in the chosen frequency sub-range and is completely independent of the stop frequency. A pen lift output simplifies recording on a chart recorder.

General purpose instrument: The PM 5132 is a general purpose instrument for a wide range of educational applications and laboratory use. Careful attention to ergonomic design makes the instrument easy to use. Pushbutton selection is provided for the waveform for example with separate controls for DC offset and pulse form.

The compact dimensions of the generator - 140 x 310 x 330 mm - ensure minimum bench space. The instrument operates on 110, 128, 220 or 238 V plus and minus 10 percent from 50 to 100 Hz and power consumption is 25 W.

Further information from: Peico Electronics & Electrical Ltd., Shivsagar Estate, Block A, Dr. Annie Besant Road, Worli, Bombay-400018.

Welding Transformer

Advani-Oerlikon (P.B.No.1546, Bombay 400 023) has brought out a new series (Ador range) of welding transformers. These are based on a novel design concept developed by the company's R & D centre.

These are low-cost, light-duty and low-current welding transformers which will satisfy the longfelt need of the small industry, auto garages, wayside fabrications and the mechanised farms for an economical, low unit consuming welding power source.

Middle-class technocrats had hitherto to depend on the conventional heavy duty transformers with maximum current capacity of 200 amps and above, whose no-load power consumption and current consumption while welding are prohibitively high. Even compared to the lower capacity transformers designed for 220 volts supply which are sometimes available in the market, the "ADOR" machines are 25 percent lighter in weight, provide a fairly high open circuit voltage of 50, and give top performance with good are striking and stable arc.

The unique feature of the "ADOR" range are, firstly, that the user has a choice of three models with maximum current capacities of 120A, 150A, and 190A respectively, depending on whether the maximum size of electrode used is 3.15 mm, 4 mm or 5 mm.

Secondly, they provide stepless current regulation. This is the first time in India that this latter feature is obtainable in a small capacity transformer. It enables the user to set the right current according to the size and type of electrode and to correct the current if fluctuations occur in the line voltage. All of them are designed for 230 volts, single phase input.

ADOR welding transformers are rated for only 20 percent duty cycle, taking into consideration the intermittent welding operations normally performed by the small fabricator in minor repair welding and in the production of grills, gates, steel windows, steel furniture, etc. They are not meant to be used for continuous production work where duty cycles are higher. The overloading is prevented by the fuses whose input ratings for the three models are 13A, 15A and 20A respectively. Many other safety features are also incorporated.

ENGINEERING EQUIPMENT

Broach Sharpening Machine

The efficiency of a broach, and with that the overall efficiency of broaching, is largely dependent on the correct maintenance of the cutting faces. Timely and expert grinding prolongs considerably the life of the broach. It is necessary that the prescribed cutting angles and rake proportions, established by the manufacturer, as well as the shape of the chip spaces, are in no way altered during the maintenance of the broach. This means that for the reconditioning of broaches, the identical preconditions are evident as during the original manufacture.

An indispensable necessity for this type of maintenance is broach grinding machine which, according to the number of broaches involved, has been equipped with varying grades of automatic control. Over several decades the most suitable constructions were evolved. The machine is guaranteed to deal satisfactorily with the required reconditioning processes and especially for: highest possible precision; efficient output; long life; independence of the facilities of the manufacture of the broaches; saving of time and transport costs; reduction of the required stocks of spare broaches as their maintenance and reconditioning on your own machine can be done rapidly.

The machine can be adapted to varying requirements by means of their special accessories. The grinding operations are: Grinding of the cutting face of circular broaches; Grinding of chip breakers of circular broaches; grinding of the clearance face of circular broaches; grinding of the cutting face of flat broaches with straight or sloping cutters; grinding of the clearance faces of flat broaches, straight or sloping cutters; grinding of the chip breakers of flat broaches; final grinding of the pitch of flat broaches.

In the case of large numbers of broaches that have to be ground, a machine which carries out these operations automatically is available.

Uniform quality of grinding results in respect of the surface quality and exactness of geometry is not dependent on the capabilities of the operator. The grinding time is reduced to a minimum. The operator is free to attend to additional machines while the machine automatically grinds the numerous faces. In addition to its main task, the machine is capable of regrinding the complete chip spaces.

Five models are available: Manual, complete hydraulic and automatic for handling of broaches 1600 to 2500.

Special accessories: A number of special accessories are available for all the models depending upon the applications. Manufactured by Karl Klink, West Germany, the machines are available under actual users' licence. For further details contact IAEC (Bombay) Ltd, 43, Dr. V.B. Gandhi Marg, Fort Bombay-400 023.

Capacitor Discharge Welder

Weldtronic (110, Kohinoor Industrial Estate, Goregaon (East), Bombay-400063), has developed a versatile press type spot welding head with a sophisticated capacitor discharge control which is at present imported. This welding head with the capacitor discharge control has wide applications in electronic and electrical industries.

The welding head is designed for simple and effortless operation to increase the efficiency of production. The head provides a range of forging force from 0.25 to 40 kg. thus making it suitable for a wide variety of production welding jobs.

The welding head is operated by an accelerated type foot pedal connected to a wire rope, which is coming out of the rocking lever. When the operator depresses the foot pedal, the upper electrode is moved downward by the movement of a ram connected in the housing of the welding head. Since the lower electrode is rigidly supported, the upward thrust created at the moment of electrode contact is transferred to the spring, compressing it to the forging force preset by the operator.

A precise energy pulse is generated by a discharge of a bank of capacitors into the primary winding of the welding transformer. The capacitors are charged from a variable single phase supply line via suitable charging resistors and a power rectifier assembly made up of diodes. The capacitors discharge into the welding transformer via a thyristor. To ensure consistency and to prevent core saturation, a polarity reversing circuit is incorporated.

A distinction of capacitance energy storage welding machines is the high stability of welding current pulses because their magnitude and duration at a given capacitance of the capacitors is solely decided by the voltage to which the capacitors are charged. The pulses are relatively short, while their magnitude is fairly large, which is particularly advantageous in welding metals having high thermal and electrical conductivity. This welding head with capacitor discharge control ensures high consistency of welding variables and weld quality.

Application: Resistor capacitor, transistor lead welding, bimetal relays, automobile relay components, miniature circuit breaker, fountain pen, watch components and so many other dissimilar micro components which cannot be welded with conventional spot welding machines.

Tension Dynamometer

Tension Dynamometer has been developed by Bharat Hydraulics, Bangalore. They are suitable for static and continuous loads.

The unit is precision built and is calibrated to a very close tolerance of an accuracy of plus or minus 1 percent of the full scale deflection and can withstand an overload of 25 percent of the rated capacity.

A direct reading dial calibrated in kg. gives instant reading and the unit is available with 150 mm or 300 mm dial. The dial is provided with a red lancet pointer which indicates the maximum reading at any load even when the main pointer returns to the zero position after release of the load. The dial is covered by unbreakable acrylic sheet as a measure of protection.

It is used for checking tension of all kinds and weighing heavy equipment in docks, harbours, godowns etc. For further details contact: IAEC (Bombay) Ltd., 43, Dr. V.B. Gandhi Marg, Fort, Bombay 400 023.

Industry Roundup

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

COSMETICS AND PERFUMERY INDUSTRY

Introduction

The use of perfumery is of extreme antiquity. Perfumery has been one of India's ancient arts and India was a famous centre for perfumes and allied products in the past. There are references in Vedas and Bhagawadgita to the burning of 'Chandan' on various occasions. The use of perfumes was profusely mentioned in Mughal period and the beginning of rose attar industry in India is ascribed to Noorjahan, the Mughal Queen in early 17th century. A flourishing perfumery industry has existed in India for a long time and Rose oil and Sandalwood oil based attars were even being exported.

The terms cosmetics and perfumery cover a wider range of compounds, such as, face creams, hair creams, scents, hand kerchief perfumes, Eau-De-Cologne, toilet waters etc. Most of these compounds are used in India and abroad as skin care/condition materials and these are being manufactured in India even at present but it has not been able to take full advantage of its old base and extremely favourable geographical condition, raw material sources as also the cheap labour. With the result the countries from West Europe like France, Switzerland, West Germany, USA and Japan have stolen march over us. Even countries like Brazil, Indonesia and Egypt quite recently have greatly surpassed India even in respect of raw materials supply.

Policy

As the industry is less capital intensive, the perfumery industry is reserved for small scale sector. Foreign collaboration is considered on merit. The approved capacity is fully utilized. The creation of additional capacity in the organised sector may be allowed on 0% export bond. Perfumery compounds are eligible for cash as 100%

Status of the Industry

India has large and growing domestic as well as foreign market for cosmetics and perfumes which can provide substantial support to the R & D efforts of the industry and trade to gain its rightful position as exporter in the world/market.

Inspite of its vast potential for raw materials the cosmetics and perfumery industry in India has not developed as it should be. These items are considered as luxurious and has not received due consideration and encouragement from government as also the general public. The growth of the industry is tardy and the tables 1 to 4 show the development pattern of the industry in terms of the number of units registered and production, both in the organised as well as small scale sector.

Table 1

Production of some items of Cosmetics, Soaps and Toiletries

(in tonnes)

Items	1968		1971		1975		1976		1977		1978	
	No. of	Produc- tion	No. of units	Produc- tion	No. of units	Produc- tion	No. of units	Produc- tion	No. of units	Produc- tion	No. of units	Produc- tion
Soaps	43	216494 (102)	44	270813 (124)	46	270082 (119)	46	268400 (118)	45	283000 (125)	45	34000 (151)
Synthetic Detergents	4	18675 (61)	5	50000 (105)	8	75220 (52)	9	78834 (51)	14	103920 (52)	14	125000 (65)
Tooth Powder	5	448 (42)	5	815 (77)	5	869 (82)	5	1299 (123)	5	8203 (774)	5	6100 (576)
Tooth Paste	8	3802 (94)	8	5033 (124)	11	4153 (97)	11	6820 (163)	11	9097 (217)	11	9925 (231)
Talcum Powder	16	3773	16	3543	16	4121	16	5477	16	6733	16	7000
Face Powder	11	397 (65)	12	53 (56)	12	69 (65)	12	70 (86)	12	74 (105)	12	80 (110)
Face Cream	5	1191 (105)	14	848 (75)	14	777 (69)	14	857 (76)	14	812 (72)	14	900 (79)

The figures in brackets indicate the percentage utilization of installed capacity

Table 2

✓ Perfumery Compounds/Essential Oils Production in Organised Sector

Year	No. of units	Production	
		Quantity in Kgs.	Value in Lakhs
1974	6	132,487	377.18
1975	6	277,373	754.57
1976	6	542,221	631.8
1977	6	644,397	778.0
1978	6	602,636	924.8

Table 3

Manufacture of Cosmetics & Toilet Aids (Small Scale Sector)

Year	No. of units	No. of Employees	Investments '000 Rs.	Production in '000 Rs.
1979	243	2240	5992	43471
1971				52551
1972				56900

Table 4

Manufacture of Perfumes & Lotions (Small Scale Sector)

Year	No. of units	No. of Employees	Investment in '000 Rs.	Production in '000 Rs.
1970	117	917	1984	23905
1971				20905
1972				27909

Table 5

India's Exports of Cosmetics Soap and Toiletries

Year	Value in Lakh Rs.
1974-75	533.0
1975-76	954.3
1976-77	1143.4
1977-78	1600.8
1978-79	1383.1
1979-80	1684.0

Inspite of this tardy growth in the industry we have been exporting these products to various countries. Table 5 shows the export performance of the industry. The panel on cosmetic and perfumes of the basis chemicals, pharmaceuticals and cosmetics export promotion council has expressed its satisfaction on the export front. As far as the demand of these products is concerned, cosmetics are finding place in common man's budget and the use of cosmetics and perfumes have become popular.

Raw Materials

Many of the essential oils viz. sandal wood oil, Lemongrass oil, Palm Rose oil, Geranium oil etc. form the main raw materials for the perfume and cosmetics along with other aromatic compounds.

India has great potentialities with regard to raw materials. Indian production of essential oils today is of the order of 3000 tonnes as against the world production of 45,000 tonnes. We produce essential oils worth only 25 million dollars a year where as the value of the world production ranges from 425 to 450 million dollars. Infact, India is one of the exporter of these oils. Table 6 shows the exports of essential oils during 1974-79.

Table 6

Essential Oils Exports

Year	Value in Rs. Crores
1974-75	9.3
1975-76	3.8
1977-78	6.2
1978-79	6.5 (Targetted)

India has got a bright future as an exporter of essential oils as is recognised widely by the highest quarters. There are immense possibilities particularly in the Assam region for tremendous step-up in the production of a wide range of essential oils.

Technical Know-how

India as traditional user and exporter of perfumes and cosmetics has the necessary technology to manufacture these products. The perfumer does not follow the physical or chemical rules or properties of the materials. Generally the compounding starts with a base or foundation stone which quantitatively forms a major part of the perfume. This basic material is immediately modified with few other materials called modifiers, usually belonging to the same odour group. Fixatives are added to the modified bases so that the perfume bases within the perfume must be correctly fixed before further blending of the groups. To this fixed, modified base, certain low boiling, fresh smelling aromatic compounds are added as the 'top note' and then finally the individual touch and artistic polishing-off of perfume oil.

Perfuming of cosmetics does not involve any difficult techniques. One should know the materials and their properties used in the perfumes.

Quality Control & Standards

Quality Control forms the most important part of manufacturing of these cosmetics and perfumes. As most of these compounds are applied to skin, care should be taken that these compounds should not contain any harmful or allergic materials as their ingredients. Indian Standards Institute has evolved a number of standards which give the methods of sampling that could be used in cosmetics and perfumes.

Research & Development

Research & Development activities in the field of essential oils, the main raw materials for the perfumery and cosmetics industry, have been spearheaded by Central Institute of Medicinal and Aromatic Plants (CIMAP). CIMAP has been harnessing its research efforts for boosting the production and export of essential oils. It has developed a new variety of coriander which has trebled the yield and quadrupled the oil content. The CIMAP has also helped to improve the agronomy of geranium, linoloe Eucalyptus, vinea rosa and citronella. CIMAP has also been popularising a much better strain of lemon grass. It has introduced French Jasmine in a big way and that the experiments have disclosed that this plant promises to give much bigger yield per hectare here than even in France. The CIMAP has successfully been experimenting with the extraction of Jasmine concentrate absolute with the use of imported hexane. CIMAP has now undertaken a rural development programme involving a large scale extension of these essential oil bearing plants in suitable soils in the country side. National Chemical Laboratory, Poona, Aromatic Chemical Wing and big industrial houses have their own research and development sections where the product development programmes are going on. Regional Research Laboratories at Bhuvaneswar and Jorhat are also putting considerable amount of effort in improving yield of these essential oil bearing plants.

Suggestions for Development

The industry is not devoid of problems. The availability of suitable raw material at reasonable price, attractive packing materials etc. are quite a few to mention. The industry can be encouraged in small scale sector.

A seminar organised at Bangalore last year recommends the following for the betterment of this industry.

- a. There is an urgent need to review at regular intervals the end user industrial market in the world vis-a-vis supply position;
- b. To develop marketing techniques for the industrialised market of raw materials, semifinished and finished perfumery products;
- c. A suitable agency either existing or to be established, is considered necessary not only to coordinate the R & D activities but also to guide the growers and producers, the item to be manufactured, keeping in mind the current and future trends in industrialized world and also bearing in mind the international competitive market.

- d. In order to cater to the needs of the end users a consistent and guaranteed supply of essential oils, confirming to the ever changing safety and quality specifications in industrialized markets is highly desirable for which UN multi disciplinary approach is called for - in this regard various agencies of the UN should play a vital role for increased production; industrial development, technology and marketing.
- e. Considering the importance of safety aspects of fragrance and flavour, the basic chemicals, pharmaceuticals and cosmetics. Export promotion council should take leading role by closely associating with organizations interested in this field.
- f. There should be separate panel in chemxcil for essential oils, cosmetics and perfumery.

Conclusions

The cosmetics and perfumery industry to some extent is dependent on packaging industry. A beautiful and attractive package counts much in successful marketing. This is evident from the containers provided by the Western Countries.

are should be taken in the packaging stage. As the ingredients of cosmetics and perfumes are of vegetable origin, industry can be said as agro based one. Efforts are being made by CIMAP and RRL to make this industry a rural biased one where 80% population live in and get benefitted with such programmes and thus solving the unemployment problem. (MSR)

Current Technical Literature

Copies of articles/documents listed in this section are available on payment of Rs. 5/- for the first 5 pages or part thereof and Rs. 1/- for every subsequent page of the photo copy or xerox copy of the article/document. While placing the order, please mention the CTL number of the SEMDOC Bulletin.

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SECTION IV

CURRENT TECHNICAL LITERATURE

RESOURCES

Energy Sources

476. ----: Work intensifies on biomass, wastes for fuel. Chemical & Engineering News, 1979, 57(40), 34-36.

Efforts in biomass and solid waste conversion focus on direct combustion, direct and indirect liquefaction, and gasification process. Projects taken up in these areas in USA, Canada, Brazil, Japan are outlined. (JBS)

477. GELLENDER M: Upgrading waste to high-grade fuel entices developers of biogas. Chemistry International, 1979, (3), 17-21.

Animal manure, sewage and some industrial wastes can be chemically upgraded into a clean, combustible fuel-biogas. Technology is at hand to produce biogas as a natural gas substitute for heating, lighting, powering engines and gas turbines. No doubt production of biogas will be further enhanced by refinements in technology and economies of large-scale generating plants.

Unlike some proponents have suggested, biogas cannot provide a major share of the world's energy requirements. But it could make a significant contribution as a hydrocarbon resource and serve as an important intermediate in waste recovery and recycling systems. (AA)

FOOD AND ALLIED INDUSTRIES

478. ----: Conditions for heat treatment and filling of fruit juices into tanks and bottles. Profodcil Bulletin, 1979, 14(3), 34-37.

Highlights the processing condition data for various fruit products differing in Ph value and the conditions for hot bottling are given. Canning of mango juice and the suitability of laquered cans are covered. (MKSS)

- *479. ----: Tapioca: its potential for processing. Food and Beverages, 1979, 2(4), 28.

480. HARIDAS RAO P: Gluten proteins: Their nature and role in bread making. The Indian Baker, 1979, 9(3), 37-42.

481. KUMAR V & MULAY C A: Processing and utilisation of sour milk. Indian Dairyman, 1979, 31(6), 391-395.

Scope of utilisation of sour milk for indigenous products is highlighted. (MKSS)

TEXTILE AND FIBRE INDUSTRIES

482. ANANTHAN T V et al: Modern weaving machinery and developing countries. The Indian Textile Journal, 1980, 90(7), 69, 71, 73, 75, 76, 77, 79.

The authors give an account of various developments in weaving preparatory and weaving relating to increase in speed, improvement in design, automation etc. which have led to modern weaving machinery. Selection of machinery is a critical issue for developing countries because of the restrictions on availability of finance, technical skill etc. An attempt is made here to spell out a few technoeconomic considerations which should form the basis of the selection of machinery.

483. MITTAL V K: Vast potential for hand-knitted carpet exports. The Indian Textile Journal, 1980, 90(6), 99, 101, 103-106.

484. NARKAR A K: Heat transfer printing on cellulosic fabrics. The Indian Textile Journal, 1980, 90(5), 153-159.

Analyses exhaustively the various scientific and technological innovations developed in this field. (BS)

485. RANKA H S: Problems and prospects of hand knitted carpets. The Indian Textile Journal, 1980, 90(6), 109, 111, 113, 115.

Reviews briefly the development of Indian carpet industry and discusses the problems of financing, training and quality control in hand knitted carpets industry. (BS)

486. SRIVASTAVA V K: Appraisal of hand knitted carpet industry. The Indian Textile Journal, 1980, 90(6), 107-108.

487. UDHANI N H: Exports of hosiery and knitwears. Hosiery and Textile Journal, 1980, 48(1), 17-18.

Reviews the exports of hosiery and knitwears from 1969 to 1978. (BS)

CHEMICAL INDUSTRIES

488. ----: Laboratory equipment, Status report. Chemical Engineering World, 1979, 14(5), 43-51.
Studies the present status, achievements and problems of the Indian small scale manufacturers, functioning in the domain of laboratory equipment.
489. BROWN A: The case for feasibility studies in the development of chemical plant projects. Chemical Age of India 1979, 30(1), 63-74.
Reviews the specific needs for feasibility studies for the development of chemical plant projects with particular reference to the developing countries of South and South-East Asia confining to the five specific industries viz. petrochemical, fertilizer, palm oil, sugar and sugar by-products and plant protection chemicals industry. (KSDR)
490. DEY N P: Carbon-disulphide. Man-made Textiles in India, 1979, 22(10), 539-543.
Enumerates the raw materials and their quality requirements and describes the different processes for manufacturing carbon-disulphide. (BS)
491. MAZUMDAR A H: Maintenance management in chemical industries (Part VI). Chemical Industry News, 1979, 25(6), 351-359.
Discusses the aspects of planning and organising maintenance work and gives the results of the case studies conducted for this purpose. (BS)
492. MUKAOPADHYAY B K: Indian salt industry. Chemical Industry News, 1980, 24(12), 843-844.
Reviews the status of the salt industry giving state-wise production (1977-79), exports (1979-80) and productivity of salt industry in USA and France. (BS)
493. SUBRAMANIAN T V: Rural industrialisation. Activated Carbon - a case study. Chemicals & Petro-Chemicals Journal, 1979, 10(10), 18-20.
Discusses the process, plant size, utilities, raw materials and project economics of activated carbon. (BS)

DRUGS AND PHARMACEUTICALS

494. GOTHOSKAR S S: Pharmaceutical industry and drug control-Current status and future perspectives. IDMA Bulletin, 1980, 11(3), 23-30.

Reviews the status of drugs & pharmaceuticals industry in all its aspects. (BS)

495. GUDSOORKAR V R: Importance of glycerin in pharmaceuticals and cosmetics. IDMA Bulletin, 1980, 11(22), 271-274.

Glycerin is one of the most useful products known in pharmacy and cosmetics. The author reviews the importance of glycerin in pharmaceuticals and cosmetics.

496. GUDSOORKAR V R: Polyethylene glycols - pharmaceutical and cosmetic applications. Pharmatimes, 1980, 12(3), 11-16.

Polyethylene glycols have been widely used in pharmaceutical and cosmetic industry due to a combination of their unusual properties particularly their water-solubility, organic solvent-solubility, low order or toxicity and wide range of compatibilities. Their applications in pharmaceuticals and cosmetics are reviewed.

497. JAIN N K: Indian pharmaceutical books and journals. Pharmatimes, 1980, 12(5), 5-6.

Brings out the problems with pharmaceutical books and journals and makes some suggestions. (BS)

498. PATANKAR A D: Manufacture and availability of basic chemicals, solvents and intermediates for pharmaceutical industry. Chemical weekly, 1980, 25(31), 70-75.

DYES

499. ----: Colouring the Grey. The Indian Textile Journal, 1980, 90(8), 53, 55, 57, 59 & 60, 66.

Reviews the status of the dyestuffs industry giving list of units in the organised sector, groupwise production in the organised sector during 1975, 1976 & 1977 and finally gives the classification of dyes and their end uses. (BS)

500. ----: Organic pigments, quinacridones. Chemisphere, 1980, 4(42), 32-33.

Enumerates the patents on quinacridones.

RUBBER

501. ----: Rubber processing, Small Industry and Business Today, 1980. 1(9), 9-11.

Outlines the uses of various compounding ingredients such as vulcanising agents, accelerators, activators, antioxidants, reinforcing fillers, inert fillers and diluents, plasticisers and tackifiers, pigments and special additives in rubber processing and gives details about the steps involved in the manufacture of rubber. (JBS)

502. LEHNEN J P: Rubber powder technology in technical goods production. Rubber India, 1979, 31(10), 12-22 & 26.

Describes the concept of rubber powder technology consisting of the main processing steps viz. mixing, compacting, extrusion and injection moulding followed by the economic aspects of rubber powder technology. (KSDR)

503. MODI V K: Rubber through the eighties-Tyre industry. Rubber News, 1979, 18(9), 37-39 & 44.

Describes the current situation, projected availability and requirement of rubbers in 1980's. (KSDR)

PLASTICS

504. ARORA N: Selection of injection moulding machine and extruders. Plastirama, 1979, 10(6), 6-11.

An attempt has been made to indicate few major factors important to a buyer to select a machine. (KSDR)

505. DIAS A B & ATHALYE A S: Diversification and new application of plastics. Plastirama. 1979, 10(7), 6-10.

Identifies the opportunities that would be available to the industry in injection moulding, extrusion and powder coatings. (KSDR)

506. SRINIVASAN S R: Growth prospects of polymer industry in India. Chemical Age of India, 1979, 30(1), 11-22.

Reviews the raw material scene in India and gives refining capacity at present and the expected capacity by 1982-83 and 1984-85, list of thermoplastic raw materials manufacturers and their licensed capacity; and the production of thermoplastic resins, their supply demand gap, thermosets production and their imports since 1965, and the projected demand of plastics during 1982-83, 1983-84 and 1987-88, raw materials requirements for manmade fibres by 1983 and 1988. (KSDR)

LEATHER INDUSTRY

507. ----: Infrastructural development for the footwear and leather goods industry. *Leather Processing*, 1980, 3(6), 25-26.

Enumerates the problems of footwear and leather goods industry and suggests some remedies for the same. (BS)

508. ----: Scope for the manufacture of leather and footwear machinery. *Indian Leather*, 1980, 14(2), 23-24.

509. BHANDARI B R: How STC has helped to promote India's shoe exports. *Leather Markets*, 1980, 9(6), 92-95.

Highlights the role of State Trading Corporation in planning and organising of shoe exports and enumerates its services. (BS)

510. MENON K R N: Organisational and corporate problems in the leather industry. *Leather Processing*, 1980, 3(5), 21-23.

Examines the scope for organisational development in the leather industry in terms of production, marketing, purchase and finance. (BS)

511. MOHIDEEN K K: Problems of the footwear manufacturer in the small scale sector. *Leather Market*, 1980, 9(6), 61-62.

Highlights problems involved in raw materials and footwear designing (BS)

512. RAO C K: Choice of technology and its assessment. *Leather Processing*, 1980, 3(6), 29-39.

Discusses the various aspects of technology transfer which lead to the choice of the right technology for the development of leather industry in the individual countries of the ESCAP region, consistent with their national aspirations and social objectives. (BS)

513. SESHAGIRI RAO K: Raw materials and infrastructure for leather industry. *Leathers*, 1979, 20(12), 17-21, 23-27.

Reviews the size of the livestock population, trends in their growth, their birth rates, death rates, slaughter policies, domestic and export demand for meat and meat products. Discusses some of the vital factors influencing the volume of production of hides and skins. (BS)

MINERAL BASED INDUSTRIES

514. ----: Ceramic colours. Kerala Industry, 1980, 27(10), 30-32.

Gives the process details, equipment, raw materials and capital outlay for ceramic colours developed by CGCRI. (BS)

515. ----: Synthetic mullite and mullite corundum. Kerala Industry, 1980, 27(10), 28-30.

Gives an industry profile of the product.

516. BROWN D R: Preparation of electrical porcelain bodies. Indian Ceramics, 1980, 23(2), 45.

517. MUKUNDAN P et al: Evaluation and utilisation of three Kerala clays for structural industry. Indian Ceramics, 1979, 22(11), 285-291.

Three varieties of clays from the outskirts of Trivandrum district of Kerala have been assessed for their suitability for construction materials with special emphasis on building bricks. It has been confirmed that these clays are essentially kaolinite with feldspar and quartz as main impurities. According to the results of physico-chemical analysis of clays and physical tests of fired bricks, it has been established that building bricks, roofing, and other tiles, stoneware pipes, crockery items and a number of ceramic materials can be produced from these clays.

518. SHARMA K D: Manufacture of ophthalmic glass. Glass Udyog, 1979, 8(2), 5-9.

Discusses the composition and methods of melting and forming ophthalmic glass. (BS)

MECHANICAL ENGINEERING

519. ASHBURN A: Devising real incentives for productivity. (Special report 704). American Machinist, 1979, 123(6) 115-130.

520. BERGEN R T V: Quenchants and heat treatment fluids. Wire Industry, 1979, 46(547), 493-500.

A brief review is given of the fundamentals of heat treatment and emphasis is placed upon environmental aspects of heat treatment which are becoming increasingly important in view of current health and safety legislation. Practical aspects of quenching, including quench tank design, cooling systems and circulation are also discussed.

521. HAGAN J T & KARLIN E W: Quality management for service industries. ISI Bulletin, 1979, 31(10), 327-330.
- Though quality management in the manufacturing sector is a well known activity, its application in service industries receives little attention. The authors describe in this paper a model quality system that could be adopted with advantage by service industries to ensure proper performance of the various jobs handled by them.
522. KHEPAR S D et al: Development of foot-operated irrigation pump. Invention Intelligence, 1979, 14(11), 451-454.
- The pump can deliver 1.5-2.4 litre/sec. from a suction lift varying from 0.3 to 1.1 metre, with an efficiency varying from 30% to 53.6%. It may cost Rs. 500-600/unit.
523. KUMAR BHAMBRI S & GUPTA S N: Preventive maintenance: A case study. Machine Building Industry, 1979, 18(7), 17-20.
- The steps followed in making effective preventive maintenance programmes are given. The need for adopting preventive maintenance is explained through a case study of the fabrication unit of a mineral wool manufacturing plant. The aspects covered in the case study are evaluation of breakdown costs, manufacturing costs and profits, causes of failures and their specific analysis. (CS)
524. LAIRD E: Plant life, profitability, and investment appraisal. Process Engineering, 1979, (May), 101, 103.
- An estimate of plant life is a necessary adjunct to depreciation and investment consideration. Explains the results of a plant life, survey and their implications. (SS)
525. PROBST L C: Maintenance corner-basic considerations of preventive maintenance program. Modern Castings, 1979, 67(12), 60-61.
- Preventive maintenance in any production situation is a must. The cost of castings not produced can often far outweigh the cost of establishing and sustaining an effective-maintenance program. Points out the various factors to be taken into account while developing a preventive maintenance programme. (SS)
526. VACCARI J A: Using materials to muffle noise. Product Engineering, 1979, 50(2), 47-51.
- Materials play a major role in suppressing noise generated by aircraft, diesel cars and trucks, business machines, and many other products. Discusses the different materials for muffle noise, its characteristics etc. (SS)

ELECTRICAL INDUSTRIES

527. DAS M K: Design of leaf spring for electrical equipment. Electrical India, 1980, 20(7), 11-16.

Springs for electrical equipment often have to conduct current in addition to work as a spring and as a result very often various trade-offs are required in respect of spring characteristics, conduction characteristics and cost. The design of leaf springs for electrical equipment is given. (MVS)

528. ESWARAN H: The Indian electrical industry. Engineering World, 1979, 8(11), 27-33.

529. MEHTA P P: Indian electric motor industry. Engineering World, 1979, 8(6), 27-29.

Describes the problems facing small scale sector in the production of electric motors. (KLR)

SENDOC Services

Featured in this section are technical enquiries that were received and the services rendered by SENDOC during the month of September 1980. The charges for short technical enquiries will be Rs. 5.00 to Rs. 10.00 per typed page. Industry profiles already available with SENDOC are charged at the rate of Rs. 10.00 each.

Sl.No.	Enquirer	Service Rendered
1.	Ent. Andhra Pradesh	Profiles on: Gobar gas, Emery grains, Welding electrodes, AAC and ACSR conductors, Camphor, Distilled water, Glucose solution, Corrugated paper boards and boxes, Handmade paper.
2.	Ent. Gujarat	Profiles on: Automobile silencers, Spark plugs.
3.	Ent. Karnataka	Profiles on: Distilled water, Glucose solution, Re-rolling mill, Bolts and nuts, Silvering of mirrors.
4.	Ent. Maharashtra	Profiles on: Fisheries farm, Candles, Bottling for cold drinks, Distilled water, Bleaching powder, Gem clips, Camphor tablets, Wire drawing.
5.	Ent. New Delhi	Profiles on: Aluminium sheets, Aluminium Circles, Aluminium utensils.
6.	Ent. Orissa	Profiles on: Jute sutali and rope, Textile woven lables. Technical note on: Tasar processing.
7.	Ent. Tamilnadu	Profile on: Plaster of Paris.
8.	Ent. Uttar Pradesh	Profile on: Ammonium Chloride.
9.	FI. Orissa	Profile on: Biscuit plant.
10.	FI. Tamilnadu	Profiles on: Rice mill, Dahl mill.

Sl.No.	Enquirer	Service Rendered
11.	SI Andhra Pradesh	Profile on: Safety matches, Corrugated paper boards and boxes Technical note on: Banana powder.
12.	SI. Gujarat	Profile on: Ice plant.
13.	SI. Maharashtra	Profiles on: Cotton seed oil refining, High quality soaps, Gummed paper tape, Iron clad switches.
14.	SI. Orissa	Profiles on: Glazed wall tiles, Mini cement plants, Agricultural implements.
15.	SI. Rajasthan	Profile on: Emery grains. Technical note on: Coated abrasives.
16.	SI. Tamilnadu	Profiles on: Washing soaps, Precipitated calcium carbonate.

Note: Ent. - Entrepreneur, FI - Financial Institution,
SI - Small Industry.

New Products and Processes

ELECTRONICS AND ELECTRICAL INDUSTRIES

Digital LVDT Indicator

The National Aeronautical Laboratory, Bangalore has developed and fabricated a single channel digital LVDT indicator (type 202 BDI) for Ashok Leyland, Madras, for linear displacement measurements. The instrument has been designed for testing automobile parts which are subjected to very low frequency oscillations.

The digital indicator developed is an accurate and sensitive basic carrier wave instrument employed with LVDT type displacement transducers. The output signal is available for recording of displacements measurable with LVDT type displacement transducers.

The instrument consists of a highly stabilised 4000 Hz sine-wave generator for excitation of the transducer, a two stage I.C.type operational amplifier and a phase sensitive detector. The displacement can be read directly on a $2\frac{1}{2}$ digit digital panel meter. A highly regulated power supply has been incorporated for a stable operation of the oscillator and the amplifier. The unit has been tested to evaluate its performance by the Transducers pilot plant of Systems Engineering Division. The experimental results obtained hitherto after intensive use of the unit in linear displacement measurements have indicated its satisfactory functioning.

The laboratory has earlier supplied one 6-channel LVDT indicator to the Department of Space for ± 100 mm. static deflection measurements of their satellites.

Specifications

Input transducer	: TDF (Linear variable differential transformer)
Excitation voltage	: 1.5 volts RMS at 4000 Hz nominal
Transducer impedance	: 100 ohms (nominal)
Sensitivity	: Continuously variable
Range	: Instrument calibrated for the range of the transducer
Indication	: $2\frac{1}{2}$ digit digital panel meter
Recorder output	: 250 mV across 2.5 k
Linearity	: 1% fsd

TV Service Wobbulator & Sweep Generator

A wobbulator or a sweep generator is a signal generator which gives a sinusoidal signal of varying instantaneous frequency. In effect, the output is an FM signal of constant amplitude. The modulating signal is a sawtooth usually, so that the frequency response of amplifiers, filters etc., could be easily displayed on a CRT, by utilising suitable detectors. The sweep generator, in conjunction with a CRT and detectors help in quick and accurate alignment of IF stages in TV receivers, thus helping TV manufacturing units and TV servicing centres.

The Central Electronic Engineering Research Institute, Pilani has developed a wobbulator for Band I channel IV TV receiver and its IF stages. The institute has also developed another sweep generator which can cater to multi channel TV receivers.

Specifications

A. TV Service Wobblers

- | | | |
|-----------------------------|---|--|
| i) Channels | : | (Band I) IV and IF stages |
| ii) Sweep width | : | Greater than 10 MHz |
| iii) Maximum output voltage | : | Greater than 50 mV |
| iv) Output flatness | : | ± 0.15 dB (within markers)
± 0.25 dB (over the channel) |
| v) Attenuation error | : | 78 dB max. in 2 dB steps
0.2 dB (below 18 dB attenuation)
1.5 dB (above 18 dB attenuation) |
| Impedance | : | 75 ohms. |
| vi) Markers | : | 33.40, 38.90, 62.25,
67.75 MHz |
| Accuracy | : | 0.15% |

Prototype has been successfully tested for dry heat, damp heat, shock etc.

B. Sweep Generator

- | | | |
|---------------|---|--|
| i) Channels | : | IF, 2, 3 & 4 (Band I),
5, 6, 7, 8, 9, 10 & 11 (Band III)
(As per CCIR B standards) |
| ii) RF Output | : | Amplitude 100 mv rms into 75 ohm
Sweep width ± 5 MHz
Flatness ± 0.5 dB |

- iii) Markers : ± 2.75 MHz from centre freq.
 ± 4.25 MHz from IF centre freq.
 Amplitude variable upto 2V max.
 Crystal controlled at 36.15, 58.65, 178, 185, 192, 199, 206, 213 & 220 MHz
 Crystal oscillator frequency accuracy ± 10 KHz
- iv) Attenuator : 81 dB max. in 2 dB steps,
 75 ohms impedance

For mechanical fabrication, welding set, shearing machine, folding machine, flypress, drilling machine and handtools are required. For testing, oscilloscope, LCR Bridge, counter, powersupply DVM, multimeter, VHF & RF signal generators, VHF voltmeters, attenuators, Q meters, spectrum analyser etc., are needed. The first five equipments are available indigenously and others are to be imported.

Raw material/components are: ICs, Resistors, capacitors, Inductors, Potentiometers, Diodes, Transistors, crystals, switches and other hardware items. All these are available indigenously, except a few precision components which are to be imported.

The demand for the product has been estimated to be about 400 pieces per year, taking into account the present status of TV industry and future plans of Doordarshan.

For manufacturing 75 Nos. of Band I channel IV type and 25 Nos. of multichannel type sweep generator/wobblers, the following investment is needed.

Fixed capital (excluding land and building)	Rs 1.8 lakhs
Working capital	Rs 2.0 lakhs

Terms of know how transfer

Lumpsum premium	:	Rs 15,000
Recurring Royalty	:	3% on sales
Nature of licence	:	Non-exclusive
Period of licence	:	7 years

FOOD AND ALLIED INDUSTRIES

Chitosan from Prawn Shell Waste & Squilla

Chitosan is a high molecular weight compound. It is formed by polymerisation (intercombination) of a chemical compound called 'amino glucose'. Naturally it is derived from a material called 'chitin'. The latter is the main constituent of the shells of marine animals like prawns, lobsters, crabs, squilla, etc.

About 40,000 tonnes of prawn head and shell wastes are thrown out of freezing and canning factories every year in India. It is mostly wasted now. Small quantities of it are dried and powdered for use as cattle and poultry feed and manure. At present we have no idea as to how much our squilla resources are. On the basis of a very rough approximation made by Indian scientists, about 7500 tonnes of this material also will be available annually if attempts are made to collect it.

Both prawn waste and squilla have got very similar chemical compositions as shown below:

	Prawn waste	Squilla
Moisture %	76.62	78.84
Protein: % on dry weight basis	39.76	44.71
Fat : " "	5.05	2.68
Chitin : " "	23.08	14.70
Ash : " "	31.13	35.42

The raw material is washed well with water. It is then boiled in dilute caustic soda solution for one hour, using 3 kg. of the solution for 2 kg. of the raw material. Caustic soda is dissolved at the rate of 1 kg. per 100 kg. of water. The watery extract is decanted. The residue is once again boiled in caustic soda solution of the same strength for the same time. The extract is decanted and preserved for isolation of the protein.

Bleaching: The shell residue is kept under bleaching powder solution or dilute bleach liquor for 30 minutes. The solution must contain 5 g. of available chlorine per litre of water. This bleaches all the pigments contained in the material. The bleaching powder solution is drained off. The residue is washed with water once and the washings decanted off. The residue is immersed in dilute hydrochloric acid (concentrated acid diluted with 7 times its weight of water) for one hour. The acidic solution is decanted off. This removes all the mineral matter. It is washed once with fresh water and decanted. The residue left is 'chitin'. *

Decacetylation: The chitin residue is treated with an equal weight of strong caustic soda solution at 100°C for 90 minutes. The caustic soda solution is prepared by dissolving 1 kg. of the material in 1 kg. of water. The alkali is decanted after the treatment and used for treating further batches of the chitin. The residue is washed with water and the washings decanted off. The washing is repeated until the residue is completely free from alkali.

* Note: The steps of bleaching and demineralisation can be avoided in the case of squilla

Drying and Pulverising: The residue is dried in the sun and powdered in a grinding mill. The powder obtained is chitosan ready for use.

Properties and uses:

One kg. of chitosan dissolved in 100 kg. of water containing 1 kg. of glacial acetic acid gives a highly viscose (thick) solution. The product finds application in sizing of cotton wool and synthetic fibres like rayon, glazing of paper and cellophane, as adhesives, and thickening agents and in pharmaceutical and cosmetic preparations. It can also be used for clarification of water and wine and as a general flocculant in metallurgical and other industries.

Electrically Heated Stainless Steel Kettle

The Central Institute of Fisheries Technology, Cochin, has designed and fabricated an electrically heated stainless steel kettle for cooking fish and fishery products. This fully indigenous equipment is designed mainly for use in laboratories and small fish processing plants.

Having a maximum steam pressure of 106 kg. per sq. cm. (15 pounds per inch square), the vessel has a capacity of cooking 40 kgs. of fish. The kettle costs Rs 8000 approximately.

The equipment consists of a stainless steel vessel with M.S. outer jacket having two industrial purpose immersion heaters fitted inside the jacket. The vessel is welded to a M.S. shaft which is supported on bearing on a tubular frame structure. The shaft is fixed with a worm gear arrangement so that the vessel can be tilted easily using the hand wheel for loading the materials. The worm gear and the heater coil terminals are enclosed in metallic box coverings so that water will not fall inside. The kettle is provided with safety valve, pressure gauge, water inlet pipe, drain pipe, steam cock etc. Since the contact parts and top lid of the vessel are made of stainless steel, the food material can be cooked hygienically. The outside of the vessel is coated with heat resistant paint.

The kettle can be worked on a 230 volts, single phase supply mains. The temperature inside the jacketed kettle can be controlled by using the control switches with indicator lamp provided with the heaters.

For operation, the vessel is held in the vertical position and water is filled inside the jacketed kettle through the inlet pipe after opening the inlet valve upto the required level so that the heaters will get immersed in water. The water level can be known by opening the steam cock fitted by the side of the M.S. outer jacket. Water has to be filled inside till it starts escaping through the cock. Now the vessel is ready for operation.

The materials to be cooked are fed into the vessel and covered with the lid. Then the heaters are switched on. Steam will be developed inside the jacketed kettle and when it starts escaping through the valve by ejecting the air inside, all the valves have to be closed. Then pressure will start developing inside the jacket and when it reaches the required pressure which can be noted in the pressure gauge, either of the heaters can be switched off so as to maintain a constant pressure. If the steam pressure exceeds, it will escape through the safety valve which is kept adjusted to the required pressure. After cooking for the required time, the materials can be taken out completely by tilting the vessel with the help of hand wheel.

Vitamin E from Wheat Germ

The Central Food Technological Research Institute, Mysore, has standardized a process for extraction of oil from wheat germ and for producing vitamin E concentrate from the oil. The know-how has been given to a private firm which sponsored this project.

The germ, which forms 2.5-3.6% wheat grain, contains about 50 mg. of vitamin E per 100 g. of germ, and 6.7-9.0% oil. This valuable source of nutrient is usually not available for human use as, during wheat milling, it gets mixed with the bran, which is mainly used as animal feed. Nearly 100,000 tonnes of wheat germ containing 50 tonnes of vitamin E and 9000 tonnes of oil could be made available from the 3.5 million tonnes of wheat annually milled by the organised roller milling industry.

Wax Emulsion

Extension in storage life of easily perishable fruits/vegetables is an important aspect for a country like India with tropical climatic conditions. The fruits/vegetables have to remain in fresh and marketable condition with minimum decay for longer periods of time. The wax emulsion when applied to fresh, healthy, mature fruits/vegetables protects them against excessive moisture loss, higher respiration rate, heat build up and thermal decomposition. As a result, the texture and quality of the fresh produce will be maintained as near to the fresh condition as possible for a long time. The wax emulsion without fungicide in the required concentration will not protect fresh fruits/vegetables against microbial spoilage. Therefore fungicides have to be incorporated into the diluted or undiluted wax emulsion before their application. In the alternative, the commodities will have to be given a prewash in the required concentration of the fungicide prior to waxing. With this in view, the Central Food Technological Research Institute, Mysore have developed a process for making wax emulsion, oil in water type (O/W) which contains 12% solids. This is mainly used for preservation of fresh fruits and vegetables and extending their storage life.

The coating of wax emulsion on the fruits and vegetables has the following characteristics: (i) it is invisible to the naked eye; (ii) it does not interfere with the natural appearance, colour, flavour and quality of fruits/vegetables; (iii) it reduces moisture loss and helps fruits/vegetables retain their external texture (iv) storage life of fruits/vegetables is extended by 50-100% at ambient and low temperatures; (v) it is economical and non-hazardous; (vi) it imparts shine and gloss to the commodity; (vii) it protects the fruits and vegetables from organisms causing fungal decay when proper fungicides are used in the required concentration in the emulsion.

There is good scope for applying wax emulsion to fruits. Over 1,000 gallons of wax emulsion have been supplied by the Institute to different parties. Wax emulsion has been used mainly on mandarin oranges. The annual demand for wax emulsion may be around 20,000 gallons, even if only 20% of the citrus fruits like oranges, are waxed.

The process consists in weighing the waxes, melting them and adding the necessary quantity of emulsifiers at controlled temperatures. Boiling water is then added until water-wax emulsion (O/W type) is ready. The hot wax emulsion is then cooled by running cold water and the volume of the wax emulsion is made up with cold soft water. The cooled wax emulsion is then dispensed into containers and stored at room temperatures. The wax emulsion is stable and does not deteriorate between 10°C and 100°C for a period of 9-12 months. The water wax emulsion once frozen cannot be thawed out.

The wax emulsion was prepared on a pilot plant having a capacity of 20-25 gallons/day of 12 hours.

Product specification:

- i) The concentrated wax emulsion with 12% solids should not precipitate out even when diluted with 0.5% of soft cold water.
- ii) On removal of water from the wax emulsion in oven at 80°C, the solids should register not less than 12% and not more than 13%.
- iii) Viscosity - 5.5 to 6 cps., pH - 9.0 to 9.4

Investigations on the use of the wax emulsion developed at the CFTRI, Mysore have been carried out extensively in India by Agriculture Universities, Government and non-Government bodies. The commercial application of the wax emulsion to mandarin oranges of Coorg and Nagpur is already established. The fruits and vegetables with or without wax coating have been compared from the point of marketability and quality. The wax fruits fetch better returns and are acceptable in taste and flavour.

The following raw materials are required for wax emulsion: Sugarcane wax, Carnauba wax, Paraffin wax, Oleic acid, Triethanolamina, Shellac, Ammonia, Refined T.B., grade Ravalgaon. All the above ingredients are available indigenously.

The machinery and equipment required are: Wax emulsion unit with stirrer, motor, speed adjuster, Jacketed S.S. round bottomed tank, M.S. tank, valves, pump, exhaust fan and burners. All these can be procured/got fabricated indigenously.

For a suggested economic unit of 100 gallons per day (12 hrs. operation), the plant and machinery required will cost Rs 23,000 and a working capital of Rs 1.35 lakhs will be needed.

INSTRUMENTS AND INSTRUMENTATION

Acoustic Anisotropy Apparatus (exclusive of electronics)

National Geophysical Research Institute, Hyderabad has developed (Patent No. 137655) a new device for determining the acoustic anisotropy of rock specimens and solid materials. A precise evaluation of acoustic anisotropy is important in earth and material science studies. It enables (a) quick measurement of total anisotropy of solids, e.g. rocks metallic samples, etc. (b) determination of limiting values of anisotropy in terms of the planes of working, (c) picturization of the nature of anisotropy variations in solids and (d) presentation of a pole diagram of distribution of wave velocities, which in turn provide the basic information regarding stress distribution in the sample. Besides research and educational institutions devoted to studies in geology, geophysics, rock machines, mining and material science, it is also useful for the mining industry.

The apparatus comprises a levelled mechanical bench on which two acoustic transducers are mounted. The sample is mounted on a sample holder in between the two transducers with a provision for its orientation and rotation through 360°. The two transducers can be moved on the bench and their movement can be measured precisely. It thus helps in the proper alignment of the transducers in order to obtain the best wave forms in the sample when the electronics is hooked up. With the aid of suitable sample holders the apparatus can be used for studying different sizes of cylindrical or spherical samples. The device incorporates mechanical aids for transducer alignment and for sample holding, giving an accuracy of 0.17°.

The work at the Institute has been carried out at laboratory scale and one unit is also fabricated, the performance of which has been found satisfactory.

The demand for the apparatus is about 10 units/year.

The main raw materials required in its production are brass rods, stainless steel rods, acoustic elements (P-Z-T) R.F. connectors, worm drive and eye bubble for levelling the apparatus. All the materials required for fabricating its mechanical parts are indigenously available. In view of limited demand, it is suggested that the product should be manufactured only by an existing scientific instruments manufacturer as a diversification programme. No special plant and machinery is required for fabricating the device.

The cost of production (mechanical unit) works out to Rs 10,000/unit. The suitable electronic gadget which goes with the mechanical part in the complete unit is readily available from the market.

Dual Densitometer

The densitometer developed by the National Remote Sensing Agency (NRSA), Hyderabad is an instrument to measure the optical density of a photographic film transparency or of a hard copy print for checking the consistency of the copies for quality control. The instrument has applications in aerial photography, remote sensing, image processing etc., where producing the required image quality repeatedly is important. For example, different levels of soil moisture or various stages of growth of crop or quality of water bodies in a scene appear as different grey values and these have to be reproduced exactly for correct interpretation. The densitometer is used in quality control of aerial photographs, computer generated films, graphic arts, bio-medical applications and in sophisticated photo laboratories for sensitometric work.

For measuring the density of transparency (film) a certain amount of light from a standard light source is made to transmit through a small portion of the film, called the resolution element, and the transmitted light through that spot is measured. Then the density 'D' at that spot is measured. Then the density 'D' at that spot is given by

$$\log_{10} \left(\frac{\text{Incident light}}{\text{Transmitted light}} \right)$$

For hard copy prints the reflected light from the spot due to an incident light at that spot is measured and converted into density units. Normally the density range is 0 to 4D for transparency films and 0 to 2.5D for paper prints. It may be noted that different photographic films and papers respond differently for the same incident light and thus create different densities on them.

A few companies in the world make densitometers for black and white and colour applications. The density ranges are 0 to 4D for transmission and 0 to 2.5D for reflection. Indigenously available densitometers measure density of black and white transparency (film) with one resolution only. The densitometer designed and developed by NRSA is a digital read out photometer and of dual type, and has the capabilities under different options, for measuring transmissions (film) densities Black and white and colour - and reflection densities of photographic prints within the range of 0 to 4D and 0 to 2DD respectively. Measurements taken with the densitometer indicate diffuse visual and opal glass density. A three and half digital display with polarity indications facilitate accurate and reproducible readings. The densitometer has a stable halogen light source, a photomultiplier (PMT) as detector, solid state circuits, and compact mechanical assembly. The incident light flux from the highly stable light source transmitted (reflected) from a film (hard copy) is collected by an optical system and impinged onto the cathode of a photomultiplier, which in turn produces a current that is proportional to the amount of light energy striking the cathode. The output current of PMT is properly amplified and converted to optical density units, and are displayed on the digital display.

The densitometer has an illuminated viewing area of 9"x9" and thus avoiding additional light table for analysing aerial and remotely sensed films. The transmission system has three useable resolutions, viz., 1 mm, 2 mm and 3 mm while the reflection system has one resolution of 6.5 mm.

Gel Scanner

Polyacrylamide gel electrophoresis has become presently an important tool for the biochemist in the separation of protein components. Different protein components are separated and obtained in the form of coloured rings after staining along the length of the gel. For better quantitative estimation, concentrations of protein components will have to be measured without disturbing the gel. The Indian Institute of Experimental Medicine (IEM), Calcutta, has developed an instrument which meets these requirements. In the IEM instrument, the gel samples are driven on a slow moving carriage in front of an optical system, and the absorption of the protein rings is measured by a photocell and an amplifier, and the results are recorded on a recorder. The laboratory has designed and fabricated the instrument, except for the recorder. All the components required for the fabrication of the instrument are indigenously available. The results obtained with the IEM instrument are comparable with those from the imported instruments.

Portable Warp Load Meter for Fishing Trawlers

The Central Institute of Fisheries Technology (CIFT) Cochin, has developed a portable type Warp Load Meter for fishing trawlers. The instrument measures the load on the warps continuously and ensures proper operation of the net and its accessories under water.

The trawl net and its accessories may undergo many malfunctioning and any such abnormalities are followed by change in warp load either upwards or downwards depending on the nature of failure. Cases like torn off codend, improper mouth opening due to fouled net etc., cause decrease in warp load while ploughing of other board in mud or entangling the net on the bottom cause an increase in load of the particular wire rope. If the wire ropes are not equally laid it will cause unequal distribution of load between the ropes. All these defects are immediately shown in the instrument by way of a change in warp load (tension). The skipper can immediately find out the defects of the system and thus rectify it, saving the time, effort and money.

Though basically it is only a measurement of warp tension, usual warp tension meters cannot be used conveniently since both ends of the wire rope are engaged one side on the net and the other on the winch. The commercially available dial gauge or load cells require the wire rope to be tied to their hooks on either side. This can be done only either by cutting the rope or loosening and bending the rope. All such methods are extremely difficult and also require much manual labour. Further, it can be done only by disturbing the routine operation of the trawl system. The mechanical type warp tension meters are comparatively very inaccurate for the purpose and also require more labourers.

The electronic warp load meter weighs only about 3 kgs. and can be easily clipped on the wire rope. The electronic display meter can be kept at a convenient remote place where it measures the tension accurately. If required, information can be fed to continuous recorders also for further detailed studies.

Though primarily it was developed for fishing trawlers, it can be used at places where warp load on ropes are to be measured conveniently without disturbing the load system. It can be used for bollard tests of engines with permanent records on paper charts for detailed characteristics studies of the engine and the measurement of loads of cranes etc. The approximate cost of this fully indigenous instrument is Rs 3500/-.

MINERAL BASED INDUSTRIES

Coating

The Central Glass and Ceramic Research Institute (CGCRI), Calcutta, has developed a textured coating based on mica powder. It is comparable to the well known 'Kenitex' textured coating used extensively in the US, Japan and other developed countries.

The coating has been developed specially for the protection and decoration of exterior surfaces. It is ideal for metal, concrete, masonry and wood surfaces. One or two coats are sufficient to fill holes and cracks and hide building defects without affecting the architectural lines. It is highly flexible and it withstands normal expansion and contraction of buildings. It provides texture, fire resistance and insulation and is highly durable and weatherproof. It can be applied by spraying and is free from chipping, flaking or peeling.

The coating is more economical than conventional painting particularly in consideration of the former's outstanding merits. It is ideal for application in industrial plants, commercial buildings, hotels, schools and houses.

The coating has the following properties:

Drying time (touch); eight hours; covering power; about 1 m²/litre; flexibility; does not crack when bent over 2.5 cm radius, fire resistance: excellent; adhesion: excellent; requires 20 kg to pull the surface; colour retention: excellent; no change after 70 hr. exposure to ultraviolet rays; water resistance: excellent.

The capital investment required for a unit which would produce 200 litres of the coating per day is ₹ 2.5 lakhs, comprising ₹ 1.0 lakh as fixed capital and ₹ 1.5 lakhs, as working capital. The cost of production is estimated at ₹ 13.50/litre.

Lithium Carbonate and Lithium Fluoride from Lepidolite

Lithium chemicals are extensively used in India. Lithium hydroxide monohydrate is used in the manufacture of multi-purpose high temperature greases for use in industries and aviation. Lithium chloride is used in making welding electrodes. Substantial amounts of lithium carbonate and fluoride are imported for use as low temperature fluxes in ceramic bodies, glasses, glazes and enamels.

Lithium carbonate is the starting material for preparing other lithium chemicals. A process has been developed for producing lithium carbonate from lepidolite (also known as lithium mica) - the only lithium bearing mineral available in the country. Lithium fluoride which is an important lithium chemical is obtained as a by-product. The process consists of the following steps; (i) crushing of ore and chemicals, grinding the ore to 100 mesh; (ii) mixing the desired chemicals and ore with water and a suitable organic binder to convert the mass into a stiff paste; (iii) pelletization of the paste by extrusion or by any other suitable method; (iv) drying of pellets; (v) sintering the dried pellets in a rotary furnace; (vi) grinding the sintered pellets to about 50 mesh; (vii) leaching the ground material with boiling water and washing the residue; (viii) separating the leach liquor from the residue by centrifuging; (ix) concentrating the leach liquor by evaporation; (x) precipitation of lithium carbonate by adding soda ash solution to the boiled liquor; (xi) separation of the precipitate by filtration; (xii) precipitation of lithium carbonate by again adding the soda ash solution; (xiii) separating most of the lithium carbonate in the liquor by filtration and washing and drying the carbonate; (xiv) recovering the remaining lithium carbonate as lithium fluoride by precipitating with sodium fluoride solution.

The investigation on the preparation of pellets and their sintering was carried out at the Central Glass and Ceramics Research Institute, Calcutta on a 110 kg/batch scale. Leaching and subsequent operations were worked out at 10 kg/batch.

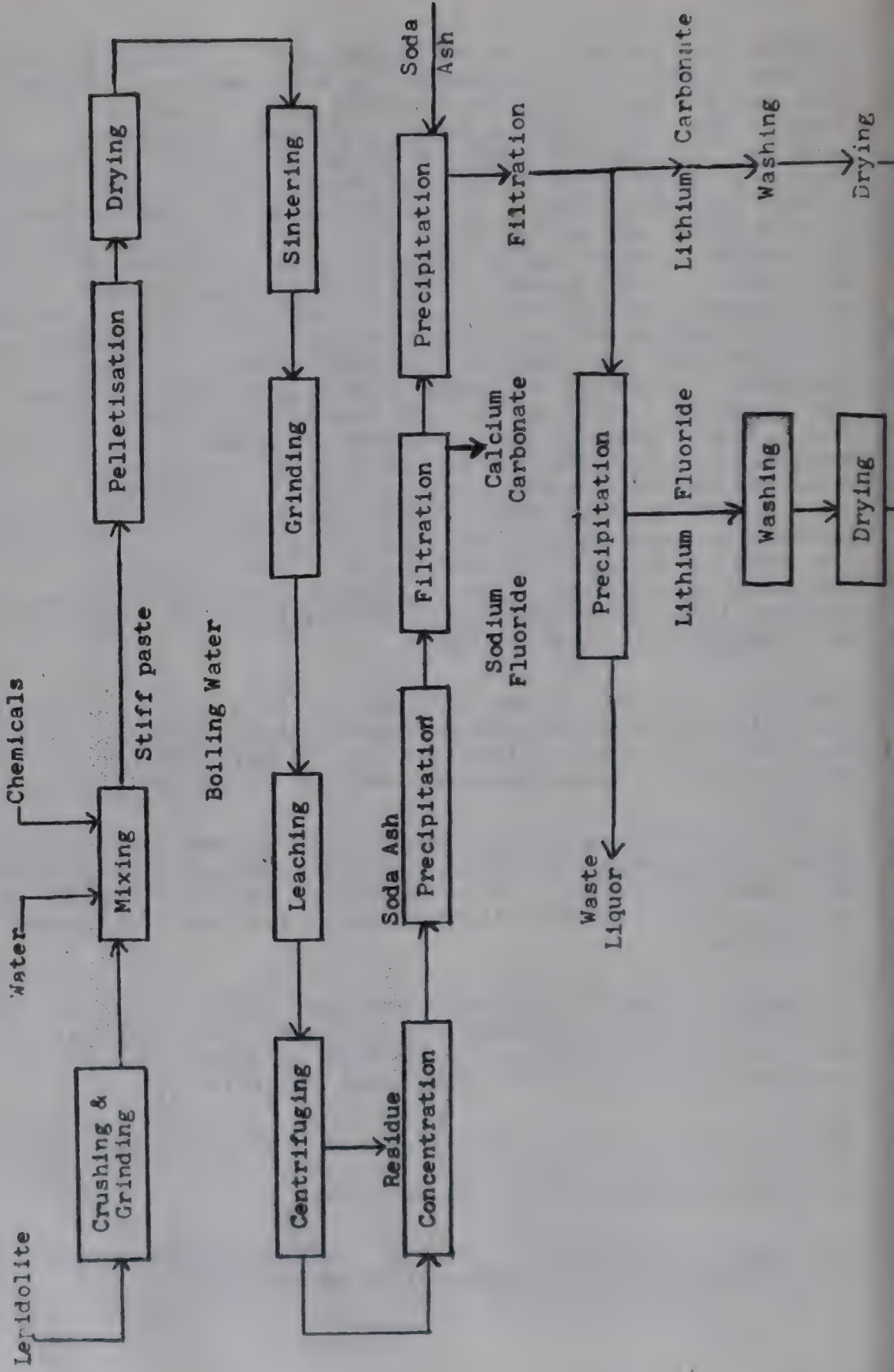
Lepidolite, the main raw material for the process, is mostly found in Rajasthan and Bihar, but the extent of deposit is not precisely known. Other chemicals required include gypsum, soda, ash, and sodium fluoride which are also indigenously available.

The major items of equipment required are jaw crusher, hammer mill, batch mixer, pelletising machine, filter press, evaporator, centrifuge, plunger, sintering furnace, and drying chamber, which can be indigenously procured.

It is estimated that a plant with a production capacity of 3 tonne/year lithium carbonate needs an investment of Rs 1.3 million, excluding land and building.

The plant is expected to provide employment for 12 persons. The process has been licensed to two parties.

BLOCK FLOW DIAGRAM FOR LITHIUM CARBONATE



Mineral Beneficiation

The processing of low-grade ores to enhance their mineral values may be considered to be the starting point for the extraction of any metal from the earth. Not all minerals are available at the highest degree of purity necessary for direct use; and with the depletion of high-grade ores, the need for the beneficiation of low-grade ores so that their mineral content can be economically utilised, has arisen. The recovery of copper from an ore containing less than 1% copper, and gold from an ore containing 5 grams of the metal per tonne, has proved the importance of mineral beneficiation.

The Indian Institute of Science, Bangalore has developed process know-how for the beneficiation of the beach sand minerals of Kerala; the manganese, copper, vermiculite and graphite deposits of Karnataka; lead-zinc ores of Rajasthan, fluorspar from Madhya Pradesh; coal and petroleum coke fines and the bauxite ore from Kashmir; and the phosphate ore from Uttar Pradesh.

The Department of Metallurgy has carried out beneficiation work on several ores for industrial application - petroleum coke fines for the silicon carbide and calcium carbide industry and phosphate ore for the fertiliser industry. The low grade phosphate ore from Uttar Pradesh has been successfully upgraded to give a higher concentrate of phosphate. The bulk oil flotation of low grade graphite ore from Karnataka containing a low percentage of fixed carbon has given a graphite concentrate of a very high percentage of fixed carbon.

Of the mineral beneficiation techniques, flotation is by far the single most important method available to mineral technologists. But the mechanism of separation involved in flotation is not very well understood. With a view to obtaining a better insight into this mechanism, an experimental set up for the measurement of zeta potential by the streaming technique has been constructed in the Department of Metallurgy.

Electrokinetic potential studies on high purity haemetite and pyrolusite with various chemical reagents to improve the selectivity between the two minerals have been taken up. It is hoped that this will lead to the development of a flotation process for the beneficiation of a low-grade manganese ores containing high iron.

Skirted Granular Piles

Although stone columns are becoming popular for reinforcing clay deposits, their use in non-cohesive soils is not so common, as recourse has always been taken to techniques like vibro-flotation, compaction piling, use of explosive charges. The Central Building Research Institute, Roorkee, U.P. has developed

another technique called skirted granular piles which provides economical and technically feasible foundation in such soils. It involves construction of skirted granular piles for reinforcing weak soils to improve strength and limit settlements.

The field studies on stress-deformation behaviour of a loose to medium, non-cohesive soil deposits reinforced with both plain and skirted granular pile have shown that the soils are capable of sustaining high loads for single or groups of 3 and 4 piles. The improvement was found to be about 280 per cent for 3 pile group and 375 per cent for 4 pile group. Besides, the ultimate load was found to be mobilised at a deformation of about 20 per cent of the pile dia, whereas the transition of stress-deformation behaviour from elastic to elastoplastic occurs at a deformation of about 7.5 per cent of pile diameter.

Non-cohesive sub-soils reinforced with granular piles can provide economical foundations for buildings as well as for other industrial structures. In addition, these may be useful in reducing liquefaction potential in fine-to-medium saturated cohesionless soils. If skirted in groups the retrieval type of foundations could be of great advantage for foundations for oil rigs. Also buildings under distress due to excessive differential settlement could be strengthened by skirting to arrest further deformations.

New Machinery and Equipment

CHEMICAL PROCESS EQUIPMENT

Capsule Sorting Machine

Model CS-30 capsule sorting machine is for inspection of damaged, underweight and unfilled capsules. Capsules are dropped gently over a nylon conveyor at finite intervals. While travelling on the conveyor, they rotate about their own axis, allowing complete visual inspection.

Underweight capsules are automatically removed by a vacuum system. Damaged capsules can be removed with vacuum probes provided, so that they are untouched by hand. The standard model sorts 30,000 capsules per hour. As rate of inspection depends on the percentage of rejects and proficiency of the inspector, the machine is provided with stepless variable speed control. If required, digital readout of production per minute can be incorporated. Minimum change of parts is required to make the machine suitable for different capsule sizes.

For more information write to: Pharmaceutical & Allied Machinery Company Pvt. Limited, 131 Kandivli Industrial Estate, Kandivli (Bombay-400067).

Soap Making Plant

The Prototype Development and Training Centre, Okhla Industrial Estate, New Delhi has developed a complete set of soap cake making plant, keeping in view the policy of the Government of India to industrialise the country-side. The total cost of the plant including Amalgamator, Milling machines, Plodder, Cake Cutting and stamping machines is about Rs.30,000/- excluding excise duty and other taxes as applicable at the time of delivery. For the convenience of the public, one such plant has been kept in operation for the demonstration purpose at the office of the Centre in New Delhi.

ELECTRONICS AND ELECTRICAL EQUIPMENT

Annunciator Systems

'RADART' Type 8755 Alarm Annunciator System uses the latest integrated circuit technology, thereby increasing the reliability and decreasing the size and power consumption of the system. It provides a means whereby a number of potentially

hazardous and remote points in any system can be monitored and displayed in a centralised control room. A great improvement in operation efficiency, safety and minimisation of the plant shut-down are achieved by the use of this system.

If in the system there occurs any fault the annunciator system initiates the alarm conditions like visual display, flashing light signal or audible alarm. It is often seen that one trouble in the system causes many other troubles. The annunciator system identifies the first of a series of faults and distinctly displays it by different flash rate to help in analysing the faults.

SPECIFICATIONS

Supply Voltage	: 230 volts $\pm$ 10%, 50Hz.
First Output	: Flashing Rate: 60/min.
Power consumption	: 4 Watts/Channel, + 10 Watts
Potential free output	
Contact rating	: 5 Amp, 230 V (Resistive)
Ambient Temperature	: 0 - 50°C
Relative Humidity	: Upto 95%
Window size	: Two sizes available.
	a) 70 x 40 mm
	b) 88 x 58 mm

Details from: Unitron Limited, 1-2, Industrial Area, N.I.T.
Faridabad-121 001, (Haryana).

Counter Timers

Marconi Instruments has developed TF 2437 and TF 2438 counter-timers, which provide all the facilities such as count, frequency measurements, period measurements and time interval measurements. TF 2437 can provide frequency measurements upto 100 MHz and TF 2430 upto 520 MHz. Both the instruments are very similar in design and appearance and the counting section is based around a single large scale integration MOS chip.

An 8 digit display incorporates a memory and features automatic positioning of decimal point, leading zero suppression and variable display time. Many other facilities are also provided for correct measurements.

For further details contact: Aimil Sales and Agencies Private Limited, India House, Walchand Hirachand Marg, P.O. Box. 119, Bombay-400001.

Ultrasonic Digital Thickness Gauge

IMECO DIGIGAGE-201 is the new digital version of the IMECO T-Meter, the long established industry standard for ultrasonic thickness measurement. It measures instantaneously wall thickness even when only one side is accessible.

The DIGIGAGE-201 employs the latest state of art in Ultrasonic pulse echo Digital instrumentation and transducer technology developed by the R & D Centre has been recognised by Ministry of Science and Technology. Operation on a single range with only one probe offers the maximum speed of measurement, high accuracy and minimum operator fatigue.

Ultrasonic pulse echo technique is employed for measuring wall thickness or remaining thickness of metals, plastics and many other hard homogeneous materials. The time of travel of the pulse through the material is measured accurately and processed electronically to read thickness directly in mm. Samples of mild steel are fitted on the instrument for calibration. The DIGIGAGE can be calibrated for other materials with the help of samples of known thickness.

Technical Specifications

Range in Steel	: 1.5 to 100 mm
Measuring Accuracy	: ± 0.1 mm
Reading Accuracy	: ± 1 decimal digit
Near Surface Resolution	: 1.5 mm Minimum thickness reading
Display	: Bright luminous 3 digit L.E.D.S.
Battery	: 6 Nos. Eveready 1035 or Equivalent
Battery Check	: Built in Battery indicator
Probe	: Special double probe of small size suitable for plane and curved surfaces upto 80°C.

General

Size	
Height	: 65 mm
Depth	: 140 mm
Width	: 190 mm
Weight	: 1.5 kg.

Accessories

1. 9V Plug in jack for external supply
2. Additional probe
3. Small screw driver & Allen Key
4. Oil Bottle

Further details from: Imeco Ultrasonics, 19-C, Shalimar Industrial Estate, Bombay-400 019.

Ultrasonic Drilling Machine: Sonidrill

IMECO Ultrasonic drilling machine uses ultrasonic power for machining hard and brittle materials such as glass, tungsten carbide, ceramics, germanium, silicon, precious and semi-precious stones etc. with ultrasonics, it is possible to carry out non-rotating, drilling, cutting, embossing, slicing, engraving operations.

The process involves generation of high frequency vibrations at the tip of a cutting tool to which a slurry of abrasive powder suspended in water is applied in a continuous flow. The cutting tool vibrating around 20,000 Hz imparts a grinding action to the workpiece. Since there is no rotating movement, it is possible to cut or drill the most complex shapes in the hardest materials. The dimensional accuracy of the cut depends on the grain size of the abrasive used.

The equipment consists of a Ultrasonic Generator, Transducer horn, the drilling tip and slurry flow arrangement. The drill uses a transducer for converting the high frequency input voltage to high frequency mechanical vibrations. Various drilling tips can be attached to the drill for different operations. The drilling tips of different sizes can be attached by soldering at the horn tips.

Specifications

Power Output	:	250 Watts peak
Frequency	:	Nominal 20 KHz
Input Voltage	:	230 Volts 50 Hz
Generator	:	Solidstate with Automatic Tuning
Transducer	:	Lead-Zirconate-Titanate sandwich construction high efficiency
Sonitron Horn	:	Specially designed Ultrasonic Horn carrying drilling tool.
Drill Stand	:	Complete with motor, base plate, slurry pump, vertical column & clamp.
Slurry Recirculation	:	Slurry motor pump and slurry tank
Extra Accessories	:	Various size drilling and embossing tools & current meter at extra cost.

Further details from : Imeco Ultrasonics, Bombay - 400019.

Ultrasonic Thickness Gauge

The IMECO T-Meter UTG-101 is a simple and specialised instrument for measurement of thickness of pressure vessels, pipe lines, corrosion of hulls in ships, and other applications where only one side is accessible for measurement. The Ultrasonic method of measurement of thickness permits measure by applying a contact probe to only one surface of the material of which the thickness is to be measured.

The UTG-101 works on Ultrasonic pulse echo technique. A high frequency pulse is transmitted in the material and is received after reflection from the other surface of the material. The time interval between the transmitted and the received pulse is a function of the thickness of the material and the velocity of Ultrasonic wave in that material. As the velocity of the Ultrasonic pulse varies from material to material, the instrument is to be calibrated with standard known thickness of the respective material. Standard specimens of steel 7 mm & 15 mm thick are provided on top of the instrument for immediate calibration and use. The probe is brought in perfect contact with the metal surface by using a coupling medium like oil, glycerine etc., as a liquid coupling medium is essential for Ultrasonic Wave or transmission.

Specifications

Range in Steel	: i) 2-20 mm ii) 4-40 mm
Reading Accuracy	: $\pm$ 0.1 mm in 0.20 mm Range $\pm$ 0.2 mm in 0.40 mm Range
Near surface resolution	: 2.00
Display	: Direct Reading moving coil meter of scale length 195 mm calibrated in mm
Power Supply	: 9V DC Dry Cell
Probe	: PZT Transducer of small size suitable for plane & curved surface upto a temperature of 80°C
Size	: Length - 187 mm Depth - 115 mm Height - 195 mm
Weight	: 2.5 kg.
Further details from	: International Meters & Electronics Corporation, 19-C Shalimar Industrial Estate, Matunga, Bombay-400019.

ENGINEERING EQUIPMENT

High Frequency Angle Grinder

High frequency angle grinder is a hand tool which operates on high frequency of 400 c/s at 208 V, three phase supply. It requires input power of two kW. The prime mover is induction motor, squirrel cage type. The motor cooling is done by a fan mounted on the rotor shaft. The rotor shaft is mounted on ball bearings. The tool is fitted with two-pole switch. The switch is operated by a lever.

The speed reduction is obtained by spiral level gears. Grinding wheel is mounted on the bevel gear shaft. Grinding wheel of 180 mm (7") is mounted.

The grinder can be used for continuous grinding and heavy weld dressing work. Its advantages are as follows: (1) It gives a higher productivity because the working speed remains constant through the full range of load, (2) better performance due to high electrical power in relation to motor weight, (3) robust due to three phase motor and (4) less breakdown time and less maintenance because there are no carbon brushes and commutator.

Address: Advani-Oerlikon Ltd. Post Box No. 1546, Bombay-400023.

Jolting Machines for Refractory Shapes

Westerwork jolting machines are extensively used in refractory industry for making special shapes. Complicated bricks that are difficult on regular presses or special shapes of smaller lots are efficiently and economically made on Westerwork jolting machines. This is so because side opening inexpensive dies can be used on these jolting machines. High compaction of refractories can be achieved in short time. Automatic lubrication and easy replaceability of spare parts are some of the features of these jig built machines. Jolting capacities vary from 225 to 350 kg. and in special cases 900 kg. Table sizes vary from 660 mm x 460 mm to 915 mm x 635 mm. Besides, foundries, Westerwork jolting machines are also extensively used in refractory manufacture by renowned companies.

For details contact: Western Manufacturing Co. (Bom) Pvt.Ltd.
5D, Vulcan Insurance Building
Veer Nariman Road
Churchgate
Bombay-400020.

Melting Point Apparatus

Apparatus for determining crystal melting points has been developed by a British company to solve the problem of eliminating the time lag between observing a change of state and recording the temperature at which it occurs. A hold button on the control unit causes the reading on the four digit display to be retained immediately.

The apparatus is used in conjunction with any microscope of approximately X 20 power. Samples are heated by a 3-mm-square platinum-resistance element of the firm's special design. The element is set in an insulating base and held on the microscope stage. The specimen, which may be extremely small, is contained in a disposable aluminium dish, measuring 2.3 mm in diameter x 0.5 mm deep, placed on the heater and covered with a glass lid to minimise heat loss.

In the instrument's basic version, heating rate is set by a rotary control. Because of its low thermal mass, the heater takes less than one minute to reach the maximum temperature of + 300°C, and cooling is similarly fast. The user observes the specimen continuously through the microscope, keeping a finger on the hold button and pressing it when a change of state occurs.

An advanced version of the apparatus permits the upper temperature to be preset and the heating rate selected in accordance with international pharmacopoeial requirements.

The control unit is 225 mm wide x 65 mm high x 175 mm deep, weighs 2 kg and operates from a 115/230-V 50/60 Hz supply.

Manufacturers : Rosemount Engineering Company Ltd,
Durban Road, Bognor Regis
West Sussex England.

Strain Gauge Transformer

A new strain gauge transformer which will operate in environments unacceptable to conventional units of this kind has been introduced by Philips.

Known as the PR 9865/00 it is used to measure compression or tension in metals and finds applications in hot rolling mills and other areas where machines are subjected to severe mechanical stresses. It can also be used for force measurement in areas like die casting machines, presses, injection moulding etc.

Both the unit and its connecting cable are resistant to oil, petrol, diesel fuel, salt water, detergents and many other types of industrial contaminants. The sensitive measuring surface is protected by heavy nickel-plating against corrosion.

The unit is easily bolted to the surface of a machine without the need for structural alterations or stopping the machine temporarily, an important factor in processes like steel rolling.

The PR 9865/00 consists of a metal strip which is fixed to the machine surface being monitored. The strip has a milled recess which weakens it locally thereby emphasising stress compared to that of the surface to which it is bolted. A foil strain gauge in the classical full-bridge configuration is cemented to the weakened surface of the transformer and transmits the compression or tension signals.

The PR 9865/00 can be used in electronic weighing applications; however calibration of the unit being weighed is recommended when used in this mode.

The unit will operate in temperatures of minus 20 degrees C to 80 degree C with short (upto one hour) operational periods of upto 100 degrees C.

Further information from: Philips India Ltd,
S and I Department, Shivsagar Estate
Dr. Annie Besant Road, Worli,
Bombay-400018.

Welding Transformer

'SUPER ARC' transformer being built up of superior silicon steel stamping ensures eddy current losses to the minimum. The primary, secondary and the reactor coils wound from high grade electrolytic copper of adequate section also ensure maximum efficiency of the set without raising the temperature of the transformer beyond the prescribed limits. The windings have double cotton insulation which is impregnated into high quality insulating varnish and baked in an electric oven.

For different sizes of electrodes the output welding current is regulated through a well designed induction regulator. The different tappings for various output currents are taken out to the brass plugs studs provided on the front panel of the tank.

The welding current regulation is done by rotation of a handle fixed at the top and the current is variable infinitely (Stepless) over the entire range and can be read at the indication plate provided in the set. The stepless regulation provides exact current settings, easy arc striking with excellent stability.

To overcome wide fluctuation in voltage, tapping plate has been provided where with the change of connection, desired current can be obtained.

All transformers are thoroughly and exhaustively checked, tested and certified, as prescribed under IS 1851-1966.

Standard accessories: Cable, Arc welder, Earth Clamp Hand/Head Screen with glass, Hand Gloves Chipping Hammer, Wire brush can be supplied at extra cost.

Optional extras: The capacitor for power factor improvement can be provided at extra cost.

Further details from : Kukreja Transformer Manufacturing Co,
A-9, Wazirpur Indl. Area, 4902,
Somani Market, Delhi-110052.

Industry Roundup

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

SEMICONDUCTOR DEVICE INDUSTRY IN INDIA

Introduction

The invention of the transistor in 1948 has been a turning point in the history of electronics. The major advantage is towards reduction in size and power consumption. The development of integrated circuits followed from the need to have miniature and reliable electronic systems. The transistor not only allowed considerable reduction in size and power consumption, but also served as an impetus for further explorations. The development of technology for transistors showed the way for developing integrated circuits. The substitution of a transistor for an electron tube reduces the number of associated passive components. The computer is constructed with integrated circuits, which can perform the function of ten transistors and their associated passive components.

Today the semiconductor based equipment find application in virtually all sectors of human activities. The market for these devices is growing rapidly with their increasing proliferation into diverse fields. The semiconductor technology has reached such a stage that it has become the determinant technology for the growth of electronics. Semiconductor devices being the key components, considerable interest is being evinced both at government level and at entrepreneur level.

In 1972-73 an Extensive study of the industry was made by the semiconductor committee set up by the chairman, electronics commission. The committee examined various aspects of the semiconductor industry like production base, demand pattern, R & D status, raw material availability technology gaps and future needs. The committee recognised the importance of availability of raw materials. The recommendation of the committee was the establishment of a production and R & D base for advanced semiconductors.

In Semiconductor Industry, the major production activity was started in 1962 with Semiconductor Ltd. (Poona) taking up the Germanium device for production. Today, BEL, CDIL, ECIL, and a few others are manufacturing both Germanium and Silicon devices. It is observed that the low demand volume is the biggest constraint faced by the Industry. It is imperative that a healthy growth of the Industry can be ensured only by large scale export either in component form or as part of equipment.

World Semiconductor Industry

Growth of production range

The semiconductor industry essentially began with diodes and transistors for consumer electronics. In the 1950s, the manufacturers were basically concerned with developing techniques and processes to achieve better yield, reliability and economy. The successful fabrication of silicon controlled rectifiers provided, a large boost to power electronics.

In the early 1960s with the advent of integrated circuits for such simple functions as logic gates and flip flops, a tremendous development place. During the late 1960s the circuit density and complexity increased tremendously allowing the production of complex circuit functions such as counter, arithmetic units, registers, decoders, A to D converters etc. The current decade is marked by an explosive growth of these devices. The new devices cost much less, and have lower power consumption, faster operating speeds, higher reliability, higher power handling capacity and greater versatility. The power handling capacity of semiconductors has since increased considerably. Thyristors that handle 4 kv and 1500 A have been manufactured.

Market & Trend

The world wide semiconductor market currently stands at over Rs.50,000 million. The present market share of integrated circuits exceeds that of discrete. Large scale integrated circuits constitute about 50 percent of its demand. There is a continuous trend towards higher level of integration. The consumer sector has expanded much beyond the limits of traditional radio, TV and audio equipment. Calculators, electronic watches and digital games have provided a large boom to LSI demand. Monolithic audio amplifiers, household, gadgets, motor controls, electronic telephone equipment, video tape recorders, light sensors, sensitive alarm circuits and automobiles have provided additional semiconductor demand.

Till about 1970, the world semiconductor market had been largely a US Preserve Later Japan started making inroads into all segments of semiconductor market. The USA still remains the largest supplier, accounting for around two thirds of the world supplies.

Trends in Production Techniques

The trend in device processing is towards higher density of integration, higher performance, mass production, automation and cost reduction. New technology and process equipment are being developed to achieve these objectives.

The design and development of new devices is now being routinely done by computer-aided design (CAD) facility. It is now common to make computer studies to predict the performance and optimise the design before any prototype to built. The CAD has become an essential tool in semiconductor development.

SEMICONDUCTOR INDUSTRY IN INDIA

The following presents a brief description of the general product range manufactured in the country.

A wide range of small signal silicon semiconductors are made for entertainment, industrial and professional equipment. Diodes, Bipolar transistors, Fets, phototransistors, zeners, and varactors diodes are also in the production range. Germanium diodes and transistors are also in regular production in India.

Starting with slow progress during the sixties, a rapid growth was registered in the early seventies peaking at 70.2 million devices in 1974. The companies producing silicon devices in large quantities currently are BEL, CDIL, sem, HC, ECIL and Punjab semiconductors. Germanium devices are being made by BEL, and sem only.

Production of Small Signal Devices

Year	Production (in million number)
1964	4
1966	8
1968	10
1970	18
1972	20
1974	55
1975	70
1976	50
1978	65

Power Devices

The growth of power device industry has been rather slow, even though considerable potential exists. A number of companies are engaged in making power transistors. These companies are BEL, ECIL and Punjab Semiconductors. All the companies are making the silicon transistors while the Germanium transistors are being made by BEL. The rated power goes upto 120 w.

In the case of power diodes, HR, Ruttonsha, UR and NGEF are the main producers. The manufacture of high power range of diodes is based on imported diffused pullets except for a few types. In the low power domain, SCRs of upto 12 A current rating and 50 to 5600 voltage rating for low frequency operations are understood to be made with indigenous diffusion. Devices for high frequency duty and inverter application which require gold doping are also made from imported chips.

Integrated Circuits

Production of integrated circuits with indigenous diffusion was initiated in 1973 by BEL, Now Ic's are being made by BEL, Sem, CDIL, and HC. At present BEL is the only manufacturer having adequate infrastructure and production expertise to manufacture ICSs from the water stage. The total volume of production at present stands at about half a million units per annum valued at about Rs. 10 million.

Table: Growth of Semiconductor production during 1971-77

Year	Low Power discrete (Value in million)	Power devices (Value in million)	Integrated circuits (Value in million)	Total (Value in million)
1971				85
1972	76	20	1	97
1973	100	20	2	122
1974	132	16	4	152
1975	128	21	11	160
1976	101	22	12	135
1977	130	25	14	169

Table: Growth of Electronics Components Industry

Year	Semiconductors (Rs. millions)	Other components (Rs. millions)
1971	75	170
1972	100	185
1973	120	200
1974	150	280
1975	150	320
1976	130	330
1977	155	375

Table: Percentage share of production of various Electronics Components in 1971 and 1977

Components	1971	1979
Semiconductors	34.4%	29.5%
Resistors	6.9%	5.6%
Capacitors	16.3%	18.5%
Electromechanical components	4.7%	6.5%
Electron Tubes	13.7%	18.7%
Others	24.0%	21.2%

Table: Import of Semiconductor Devices

<u>Transistors</u>	Item	Value in million	
S.No.		1976	1977
1.	Silicon Bipolar transistor	0.148	0.547
2.	Germanium Bipolar Transistor	0.013	0.028
3.	Transistor NES	3.852	4.383
4.	Power transistors	0.470	0.801
5.	Special transistors	-	0.169
6.	Field effect transistor	0.013	0.065
<u>Diodes</u>			
1.	Diodes (General)	0.450	0.585
2.	Germanium diodes	0.014	0.019
3.	Zener diodes	0.172	0.188
4.	Tunnel diodes	0.042	0.090
5.	Photo diodes	0.024	0.008
<u>Microwave devices</u>			
1.	Transistors	0.052	0.141
2.	Diodes	0.333	1.593
<u>Opto Electronics Devices</u>			
1.	LED	0.117	0.478
2.	LCD	-	0.007
	Silicon controlled rectifier	1.312	1.227
	Integrated circuits	14.921	16.107

LIMITATION OF THE INDIAN SEMICONDUCTOR INDUSTRY

The problems of Indian Semiconductor manufacturers are quite distinct from those faced by the manufacturers in the advanced countries. Some of the problems of the Indian Semiconductor Industry are:

- i. Small market size
- ii. Problems associated with raw material and equipment
- iii. Inability to make process and design changes
- iv. Inability to respond to sudden spurts in demand
- v. Lack of professional grade semiconductors.

Packaging Technology

While planning for a semiconductor industry, a careful consideration of packing technology is necessary. Due to the high degree of development and innovation, the IC technology has greatly advanced in recent years. However, packaging technology could not keep abreast with this development. Packages were not developed functionally for IC's. Due to neglect of this area, present IC packages are less functional and costlier. Some times the packaging cost can be more than the chip cost. It is observed that the majority of device failures are either assembly or packaging - oriented.

Some commonly available package types are

- i. TO-5 = To-type
- ii. Flat pack
- iii. DIP - plastic = Dual in-line package
- iv. Nonstandard package

To-Type

This hat-shaped metal packages were originally very popular as high reliability transistor packages, and have also gained some popularity as IC packages. The common types are To-5, To-18.

Flat Packs

Due to light weight and small size, flat, packs are used extensively in aerospace industry. Flat packs are available both in rectangular and round shapes. It is the only package that allows high number of leads in relatively small space.

Dual-in-line package:(DIP)

Dual-in-line packages are the most popular packages these days and are best suited for automatic insertion. The most popular DIP's are with 16 and 24 pins. The DIP is the most common configuration today and houses not only chips, but also passive components.

Non-standard packages

Non-standard packages are mostly used for packaging hybrid integrated circuits to fit into special needs. Generally these are of plastic material. Even for extremely complex monolithic IC, such non standard packages are used.

Material for packages

The primary material used for construction of these packages is of four different types:

(1) Metal, (2) Glass, (3) Ceramic and plastic.

Metal packages are used for Semiconductors for better reliability, excellent sealing. Metal packages are rather costly and economical only when produced in very high volume.

Glass and ceramic packages have advantages over metal packages, both being insulators, provided with automatic electrical insulation. Some packages are made of a mixture of ceramic and glass which are less costly than the ceramic packages.

Plastic packages are more recent and have the advantage of great design flexibility and are much cheaper than ceramic packages. Such packages are generally used in high volume single chip circuits.

It is clear that packaging development and production is a very important area and should not be neglected. It is expected that by 1980-81, the production of various types of packages worth Rs. 9 to 10 crores will be required. The standardization of packages can help in reducing the number of types required.

R & D work of Semiconductor Material and Devices in India

The R & D in the area of semiconductor material and devices has engaged the attention of the following, national laboratories, academic institutions and public sector companies:

National laboratories	Academic Institutions	Industry
1. Solid state physics laboratory, New Delhi (Defence R & D organisation)	1. Indian Institute of Science, Bangalore	1. ECIL Hyderabad
2. Central Electronics Engineering Research Institute Pilani, CSIR	2. Indian Institute of Technology at Bombay Kanpur, Delhi, Madras Kharagpur	2. BEL Bangalore
3. Tata Institute of Fundamental Research Bombay (AEC)	3. Other universities and institutions have also some work in progress allied to their teaching programs	3. SEM and CDIL have worked on development for device manufacture
4. National Physical Laboratory, New Delhi (CSIR)		

R and D effort in the semiconductor area was initiated about 6 to 7 years back. Work on silicon material development has been practically given up after considerable effort. Device development has been overtaken by industries importing technology to meet immediate market demand of devices in the entertainment field. Chip import has also had a damping effect.

Government Policy

Licensing: Prevailing Policies

Licensing has resulted in over capacity, in relation to the demands within the country. In the case of silicon, there are 117 million devices issued to active licenses, but industrial licenses have been granted for 96 million, and production capacity established is only 46 million; production during 1971 was only 16.5 million. In the case of Germanium, the Licensed Capacity is 23 million, a capacity of 19 million has been installed and production of 18 million devices has achieved.

Some arguments in favour of licensing policies are:

- a) Competition may bring down prices
- b) If licenses are issued to a number of firms, at least some may succeed.
- c) A large capacity may promote export.

Licenses have also aimed at controlling product mix based on broad devices like diodes, rectifiers, transistors, integrated circuits, zeners, thermistors etc.

The licenses contain a provision that at least 20 percent of the capacity should be utilised to produce professional grade devices.

The estimates indicate a requirement of about 35.0 million germanium devices, and about 78 million silicon devices and about 0.6 million of other types. A large number of types are involved and it is estimated that at least 880 types would be required in 1979-80. This diversity may tend to reduce production quantity in India, because production may not be feasible in cases where the demand is small.

CONCLUSIONS

The above discussion has clearly brought out the need for our country to take a major step forward in the areas of semiconductor devices. It has been pointed out that in integrated circuits, though the need to make digital IC's is much greater, making linear IC's would have to be considered equally seriously. It should also consider making some of the special circuits that would be required in sufficiently large value and some special semiconductor devices. The desirability of making a serious start on some of the microwave and opto electronic devices and related materials has been pointed out. Any semiconductor devices production programme requires a strong R & D backing and considerable capital investment. All these factors suggest starting a new public sector organisation devoted entirely to the semiconductor device activity. (BSR)

Current Technical Literature

Copies of articles/documents listed in this section are available on payment of Rs 5/- for the first 5 pages or part thereof and Re. 1/- for every subsequent page of the photo copy or xerox copy of the article/document. While placing the order, please mention the CTL number of the SENDOC Bulletin.

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CURRENT TECHNICAL LITERATURE

RESOURCES

Waste Utilisation

530. ASLAM ALI M. & BHASKAR T.D.: Utilisation of coconut pith for the manufacture of oxalic acid. *Coir*, 1980, 24(2), 9-12.
Highlights the uses of coconut pith and production of oxalic acid on pilot plant scale. Also covers oxalic acid manufacturers in India and flow process chart of production using coconut pith by oxidation process. (MKSS)
531. CHATTERJEE P. et al: Jute stick as cellulosic raw material. *Indian Pulp & Paper*, 1980, 34(4), 9-10.
Some of the perspective uses on various scales of jute and mesta sticks are described. (BS)
532. CHATTERJEE P.B. & DAY A.: Pineapple leaves awaiting commercial utilisation. *Textile Trends*, 1980, 22(10), 45-47.
Reviews the pineapple plantation and problems of planters in India. Discusses the method of making fibres from leaves, fibre quality, use of fibres in textiles and as cellulosic raw material. (BS)
533. DURGAPAL B.C. et al: Vegetable waste management. *Chemicals and Petrochemicals Journal* 1979, 10(12), 22-24.
An attempt has been made to discuss the effective utilisation of some vegetable by-products and wastes which are at present either under-utilised or not utilised at all. Their utilisation would also be helpful in reducing the scarcity of some essential raw materials used in our industries.
534. KADIRVEL R.: Tapioca as poultry feed. *Poultry Advisor*, 1980, 13(9), 21-24.
Examines the nutritional element of tapioca and its utility as poultry feed. (MKSS)

535. KISHORE K. et al: Utilisation of distillery waste. Chemical Age of India, 1979, 30(9), 823-826.

During alcohol production, yeast sludge settles out after fermentation as solid waste and alcohol is recovered by distillation of fermented wash. After recovery of alcohol, the spent wash is another waste product of the distillery. The disposal problem may be solved by utilising the yeast sludge and the spent wash. The yeast sludge may be used as cattle feed, whereas the spent wash may be digested anaerobically to produce methane. Spent wash, rich in organic and inorganic materials, may be used to supplement the fermentation medium for production of valuable compounds like organic acids, enzymes, vitamins, aminoacids, etc. Recovery of the potassium salts from the distillery waste has also been attempted.

536. ROBSON T.O.: On taming an aquatic menace. Report - News & Views from the World Bank, 1980, (Mar.-Apr.), 1,3,6.

The spread of water hyacinth to many parts of the world, the control measures that are being considered, and the promising and exciting ideas of using it as animal feed, compost, paper, biogas source, etc., are discussed. (JBS)

TEXTILE AND FIBRE INDUSTRIES

537. CHAND, R.: Sepu: Case study of a village wool industry. The Indian Textile Journal, 1980, 90(7), 101-104.

The vital importance of wool lies not only in its use for making warm garments but also in the livelihood it provides to shepherds. Sheep-rearing and wool production is a village industry which must be encouraged lest the country loses its wool producers once for all. The author presents a case-study of Sepu a wool-producing village of Pithorgarh district in U.P.

538. MEHTA P.C.: The textile auxiliary industry in India. Colour & Chemical Weekly, 1979, 5(5), 49-51.

539. MUNSHI V.G. & TAMHANKAR H.V.: The design of small scale lint operator. Journal of the Textile Association, 1979, 40(4), 141-144.

A modified Lint Opener has been designed for opening small cotton lint samples to be used for Micronaire value and maturity determinations on the Micronaire instrument. (AA)

540. PARIKH J.C.: Hosiery industry in India: Problems and prospects. Hosiery and Textile Journal, 1980, 48(2), 8-10 & 12.

Discusses the structure, level of technology, raw materials, machinery and training facilities for hosiery industry. (BS)

541. VERMA, G.K.: Ludhiana knitting industry adopting modern technology. The Indian Textile Journal, 1980, 90(4), 113-115.

The knitting industry in Ludhiana as elsewhere in India, started in a small and disorganised way with poor technology and marketing strategy. However, it is now efficiency and quality conscious and has an eye on export markets. The author considers the new awareness among the entrepreneurs in Ludhiana.

CHEMICAL INDUSTRIES

542. ----: Calcium carbonate. Journal of the Colour Society, 1980, 19(1), 51-53.

Highlights the properties and uses of calcium carbonate and gives a formulation for paint. (KSDR)

543. ----: Chlor-alkali industry: A status report. Chemical Engineering World, 1980, 15(1), 25-29.

Presents a review of caustic soda and soda ash industry in India. (KSDR)

544. ----: Sodium gluconate as a speciality chemical in industry. Indian Chemical Manufacturer, 1980, 18(3), 27-32.

Identifies sodium gluconate as a speciality chemical of which many in our country are unaware. Surveys its use in four major applications; bottles washing, electroplating, boiler cleaning and sequestration. (CV)

545. ADHIA J.D.: Soda ash industry-world-wide. Chemical Age of India, 1980, 31(4), 311-322.

Reviews the production and utilisation trends of soda ash in major producing countries of the world. Enumerates the natural deposits of soda ash in different countries. (BS)

546. ASHY M.A et al: Production of citric acid. Indian Chemical Manufacturer, 1980, 8(7), 19-26.

Discusses the chemistry and manufacture of citric acid.

547. KHARBANDA O.P.: Sodium carbonate (soda ash).
Chemical Weekly, 1979, 24(34), 276-281.

Process flow chart for the manufacture of soda ash in solvent process with material requirements and technoeconomic data are given. (MSR)

548. KRISHNAN P.P et al: Greases; their selection and care. Colourage, 1980, 27(13), 31-33.

Discusses about the selection, general characteristics, care and use of greases. Also outlines the operating requirements. (CV)

549. McCALLION H.: Photofabrication (Technical file No. 74) Engineering, 1980, 220(2), 1-iv.

Describes the process of photofabrication and its applications. Photofabrication is the name for the process of manufacturing components by the use of acids from a photomaster tool without a pressing or fine-blanking operation. It is also known as chemical milling, photoetching, chemical etching (MVS).

550. TRIVEDEI H.M.: 8-Hydroxy quinokine from A. Aniline/ B. Phenol. Colour and Chemicals Weekly, 1980, 6(14), 29, 31, 33-34.

Provides a complete profile of 8-hydroxy quinoline that gives information on various aspects like demand, application, technologies, processes, economy, project investments, etc. (CV)

551. VENKATESWARAN S.L.: Ethyl alcohol from sugarcane. The Chemical Times, 1980, 7(11), 8-10.

Discusses the technology of ethyl alcohol production from sugarcane. (BS)

DYES

552. ----: Direct dyes - a preliminary feasibility study. Industrial Researcher, 1980, 6(4), 281-291.

Reviews the past and present structure of the direct dyes industry, and its past growth, with a view to assess the future potential market. Examines the feasibility of the project, for the establishment of a plant for manufacturing direct dyes, which includes the examination of technical and financial viability of the project as well.

553. ----: Phenomenal progress of the dyestuffs industry in India. Colour & Chemical Weekly, 1980, 6(5), 32-35.
- Gives the statistics of group-wise production of dyes in organised sector in 1975, 76 & 77, itemwise exports of dyes and dye intermediates for the years 1976-77, 1977-78 and 1978-79 and itemwise exports of dyes & dye intermediates for 1976-77, 1977-78 and 1978-79. (BS)

DRUGS AND PHARMACEUTICALS

554. ASHA INGLE: Recent advancements in direct compression. Pharmatimes, 1979, 11(6), 13-16.
- Discusses the economical and technical advantages of making tablets by direct compression and advocates the rise of granular dicalcium phosphate. (MSR)
555. DIVATIA K.J.: Problems and prospects of the pharmaceutical industry in India. Industrial Researcher, 1980, 6(4), 247-248.
556. RAMACHANDRAN A.: The growth of pharmaceutical industry in South India. Chemicals and Petrochemicals Journal, 1980, 11(2), 29-31.

PLASTICS

557. ----: Product profile. HDPE monofilament yarn. Popular Plastics & Rubber, 1980, 25(2), 35-36.
558. DODGE P.T.: Troubleshooting HDPE processing problems, Part-I - rotational molding. Plastics, Design & Processing, 1979, 19(3), 50-53.
559. DOWD L.E.: Troubleshooting HDPE processing problems, Part-III - Tubular blown film extrusion. Plastics Design & Processing, 1979, 19(5), 40-45.
560. DUTTA A.S.: Plastics industry in SSI sector. Popular Plastics and Rubber, 1980, 25(6), 9-10.
- Detailed statistical data regarding the country's capacity and production of main plastic raw materials are given.
561. JOYNER R.S. et al: Troubleshooting HDPE processing problems. Part II. Blow moulding. Plastics Design & Processing, 1979, 19(4), 45-49.
562. JOYNER R.S.: Troubleshooting HDPE processing problems. Part IV - sheet extrusion. Plastics Design & Processing 1979, 19(7), 43-47.

563. VERGHESE K.A.T.: Blow-moulding-processing. Indian Rubber & Plastics Age, 1980, 16(4), 24-30.

The process of blow moulding can be divided into extrusion blow moulding, dip blow moulding, Culus process, injection blow moulding, stretch blow moulding, etc. Of these different processes by and large, extrusion blow moulding is the most popular and therefore, this paper mainly deals with extrusion blow moulding and the other processes are considered as developments.

RUBBER

564. ----: The rubber industry in India - A review. Industrial Researcher, 1980, 6(4), 293-297.

Rubber may be broadly classified into 3 categories: (i) Natural Rubber, (ii) Synthetic Rubber and (iii) Reclaim rubber. The production, imports, consumption and prices of rubber are discussed as well as the rubber goods industry with the statewide distribution of rubber units. (JBS)

565. FLITNEY R.K.: Advances in rubber seal technology. Popular Plastics & Rubber, 1980, 25(6), 34-38 & 40.

LEATHER INDUSTRY

566. ----: Leather garments production. Leather Markets, 1980, 9(6), 81-83.

Reviews the status of the leather garments industry in USA, India, Scandinavian countries, UK and West Germany. (BS)

567. AGARWAL B.L.: Manpower economics, regional imbalance and promotional policy for leather industry. Leather Processing, 1979, 2(Annual number), 23-28, & 33-36.

Reviews the characteristics of employment, regional imbalances, other economic aspects and occupational distribution and requirement of skills of leather industry giving statistics of number of units and employment from 1961 to 1972, regional dispersal of livestock, economic co-efficients according to various sources, occupational pattern of workers in the leather industry in private and public sector and educational distribution of workers in leather industry in private and public sectors and finally highlights the management/promotional problems and policies. (BS)

568. DURAIVELAN C.K.: Indian leather industry in 2000 AD. Leather Processing, 1980, 3(6), 19-21.
Reviews the leather industry in the past and present in all its aspects and examines the scope for the growth of the industry upto 2000 AD.(BS)
569. HIGHAM R.D.: Expanding world of leather. Journal of the Indian Leather Technologists' Association, 1979, 27(5), 3-10.
Examines the changes in all aspects of the world's leather industry and trade. Highlights the types of leather industry developments, potential of world production in 2000 AD and per capita consumption of leather shoe. (BS)
570. MOHIDEEN K.K.: Developments of footwear industry. Leather Markets, 1980, 9(10), 25-27.
Enumerates a few suggestions for the developments of the footwear industry in the country.
571. MOHIDEEN K.K.: Problems of the footwear manufacturer in the small scale sector. Indian Footwear, 1980, 4(2), 17-18.
572. SHARPHOUSE J.H.: Technological developments in un-hairing and chrome tanning. Leather Markets, 1980, 9(6), 63-65.
Briefly discusses the two processes no soak 'liming' of salted hides and minimal chrome tannage. (BS)
573. SUBRAMANIAN V.V.: Leather auxiliaries - Some points to ponder for the tanner? Indian Leather, 1980, 13(12), 17-29.
Highlights the basic factors by which the tanner customer can look into the auxiliary products in depth and understand the implications of the nature and qualify of such products with reference to their application and quality standards. (BS)

MINERAL BASED INDUSTRIES

579. ----: Refractory-an overview. Plant Engineering, 1979, 33(6), 125-127.
Discusses basic features and heat-flow characteristics of refractories. (SS)

575. BHASKAR RAO H.V.: Super refractories. Glass Udyog, 1979, 8(1), 37-42.

Outlines the replacement of conventional refractories (manufactured from naturally occurring raw materials like clays, quartzite, bauxite, etc.) by super refractories which are manufactured from synthetically fused grains.

Important super refractories like silicon carbide refractories, fused mullite refractories, fused aluminium oxide refractories, electrocast refractories and zircon refractories are discussed, giving their important properties and uses.

576. PRASAD K.K.: Refractories in the next decade in India. IRMA Journal, 1980, 13(1), 5-10.

Reviews the changes taking place in the application of refractory products and subsequent effects on demand, production methods and technology. (MS)

577. SANGA S.V.: Review of glass types available for packaging parenteral solutions. Indian Journal of Pharmaceutical Sciences, 1980, 42(1), 1-7.

The chemical durability of glass containers for packaging parenteral solutions is of utmost importance. A knowledge of the different glass types available and their behaviour to attack will help in the proper choice of containers. A review of the different types and their composition is provided. The nature and mechanism of chemical attack, as well as the products of reaction are discussed. Treatments to improve the surface durability are described. Attention is drawn to the differences between moulded containers and containers made from tubing. Flake formation is briefly described.

578. SHARMA K.D.: Methods of manufacture of optical glass. Glass Udyog, 1979, 8(1), 21-27.

Discusses the peculiar problems involved in making optical glass. Outlines the raw materials and glass compositions and also the methods of melting and forming. Stresses the need for annealing of slabs and blanks, describes the steps in inspection and quality control and points out standards specification numbers for reference consultation.

ELECTRICAL INDUSTRIES

579. CHABRA O.P. et al: Glass F & H winding wires, Electrical India, 1980, 20(11), 21-24.

Reviews the progress made in the elementary copper conductor insulation to be utilised with the modern insulation system as well as the quality of range of conductors used in BHEL, Hardwar. (MVS)

580. KITZANTIDES F.K.: NEMA-electrical standards aim for safety and reliability. Consulting Engineer, 1980, 54(1), 82-85.

The National Electrical Manufacturers Association (NEMA) provides a legal forum where competing manufacturers can meet and draft standards that help eliminate misunderstandings between themselves and the users of electrical products. (SS)

581. MARGOLIN B.: Stepping motors. Electronic Products Magazine, 1979, 22(4), 35-44.

Describes the steppers in detail, which role out strips of paper in hand-held printing calculators and adjust the fuel mixture in automobile carburetors and also play an important role in drive and control field. (VVR)

582. PHILIP P.K.: Insulation pressboard for transformers. Electrical India, 1979, 19(24); 5-13.

Reviews various properties of insulation pressboards used in transformers in the light of international and Indian standards. (MVS)

ELECTRONICS INDUSTRIES

583. ----: Designing crystal filters. Electronics Industry, 1980, 6(2), 25-27, 29.

Provides a basic understanding of the subject covering both existing crystal filter technology and practical design techniques with circuit diagrams, graphs and tables. (VVR)

584. ----: Electronics components industry in India. Electronics for You, 1979, (Mar), 27, 29, 30, 33, 34, 36 & 37.

Gives the list of the raw materials and piece parts required for the manufacture of electronic components for which the duty reduction has been considered by the government and notifications issued to that effect-positions as on November 30, 1978. Also gives the production data of electronics components and demand projections of component for 1983-84. (VVR)

585. BEYONON J.D.E.: Charge-coupled devices-concepts, technology, and limitations. The Radio and Electronic Engineer, 1980, 50(5), 201-204.

Explains the principle of operation, structure and speed limitations of charge-coupled devices. The required diagrammatic representations and graphs are given. (VVR)

586. BOAK S.: Miniature speakers. Electronic Products Magazine, 1979, 22(6), 69 & 70.

Explains the miniature speakers smaller than many transducers, which offer low power consumption and wider frequency response, especially at the low end. (VVR)

587. CHOPRA S.P.: Electronics components industry in India. Electronics for You, 1980, 12(2), 29,31,32.

Growth of the industry, production, demand, exports, imports, etc., of electronic components are given. (VVR)

588. GURURAJA K.: Components for professional electronic equipment. Electronic Review, 1979, 7(1), 6-7.

Briefly discusses the present status of fixed resistors, variable resistors, fixed and variable capacitors, and electro-mechanical components. (VVR)

589. GURURAJA K.: Copper and copper alloys in the electronics industry. Electrical India, 1980, 20(8), 13-17.

595. HARIDAS V.K.: The technique of circuit printing and etching. Electronics for You, 1979 (Mar), 25.

Briefly explains the etching or subtracting process in which unwanted areas of conductor are removed from the surface of the insulator with a chemical solution or etchant. (VVR)

591. KRISHNAMURTHY T.G.: Manufacture of medical electronic equipment. Chemical & Petrochemicals Journal, 1979, 10(5), 9-11.

An attempt has been made to assess the present status of medical electronic industry and the future possibilities. Names of the leading manufacturers and their products are listed.

592. PRASAD T.N.S.: Salient features of solid state relays. Electronics for You, 1980, 12(2), 35-37.

Explains the solid state relays in which a LED and photo detector are used for coupling the load switches with the control circuit. The blocked diagram of such relay and its characteristics and advantages are given. (VVR)

SENDOC Services

Featured in this section are technical enquiries that were received and the services rendered by SENDOC during the month of October 1980. The charges for short technical enquiries will be ₹ 5.00 to ₹ 10.00 per typed page. Industry profiles already available with SENDOC are charged at the rate of ₹ 10.00 each.

Sl. No.	Enquirer	Service Rendered
1	2	3
1.	Con. Gujarat	Profile on: Rubber reclaiming unit
2.	GD. Orissa	Profiles on: Cashewnut processing, Sisal fibre
3.	FI. Uttar Pradesh	Profiles on: Bolts and nuts, Bolts-high tensile, Hosiery
4.	Ent. Andhra Pradesh	Profile on: AAC & ACSR conductors
5.	Ent. Andhra Pradesh	Profile on: Glass bottles
6.	Ent. Andhra Pradesh	Profile on: Hyderated lime
7.	Ent. Andhra Pradesh	Profile on: Industrial Hand gloves
8.	Ent. Andhra Pradesh	Profile on: Lime burning, Lime motor units, Lime industry, Pulveriser and blender Groundnut oil extraction
9.	Ent. Andhra Pradesh	Profile on: Mosaic tiles
10.	Ent. Andhra Pradesh	Profile on: Welding electrodes
11.	Ent. Bihar	Profile on: Hand tools
12.	Ent. Gujarat	Profile on: Corn flake
13.	Ent. Karnataka	Profile on: Hosiery industry
14.	Ent. Karnataka	Profile on: Ice plant
15.	Ent. Karnataka	Profile on: Rice milling
16.	Ent. Gujarat	Profile on: Aluminium cables
17.	Ent. Gujarat	Profiles on: Automobile rubber moulded goods
18.	Ent. Gujarat	Profiles on: Leather tannery, Leather tanning and dressing

1	2	3
19.	Ent. Gujarat	Profile on: Camphor, Chlorine tablets
20.	Ent. Kerala	Technical Note on Papain
21.	Ent. Madhya Pradesh	Profile on: AAC & ACSR conductors
22.	Ent. Maharashtra	Profile on: Conduit pipes metallic
23.	Ent. Orissa	Profiles on: Distilled water and glucose solution, Glass ampoules
24.	Ent. Punjab	Profile on: Ice plant
25.	Ent. Rajasthan	Profile on: Hardboard from saw dust
26.	Ent. Tamil Nadu	Profile on: Lubricating oil
27.	Ent. Uttar Pradesh	Profiles on: Paracetamol, Napthols, Technical Note on Cloramphenicol
28.	Ent. Rajasthan	Profile on: Welding electrodes
29.	Ent. Madhya Pradesh	Profile on: Detergent powder
30.	Ent. Orissa	Profile on: Rerolling mill
31.	Ent. Maharashtra	Profile on: Metallic conduit pipes
32.	Ent. Maharashtra	Profile on: Cardboard from bagasse
33.	Ent. Maharashtra	Profile on: Enamelled copper aluminium wire
34.	Ent. Maharashtra	Profile on: Zinc oxide
35.	Ent. Maharashtra	Profile on: AAC & ACSR conductors
36.	Ent. Maharashtra	Profile on: Straw board
37.	Ent. Maharashtra	Profile on: Stapples
38.	Ent. Maharashtra	Profile on: Miniature lamps
39.	Ent. Maharashtra	Profile on: Banana fibre
40.	Ent. Maharashtra	Profile on: Brass utensils
41.	Ent. Maharashtra	Profile on: Cardboard from bagasse
42.	Ent. Maharashtra	Profiles on: Corrugated cardboard boxes, Corrugated paper board boxes, Banana powder, Wooden flush doors, Barbed wires
43.	Ent. Maharashtra	Profile on: Sulphuric acid
44.	Ent. Maharashtra	Profile on: Gums
45.	SI. Andhra Pradesh	Profile on: Plastic cane, Speciality papers
46.	SI. Andhra Pradesh	Profile on: Rubber vee and auto fan belts
47.	SI. Andhra Pradesh	Profile on: PVC pipes, rigid

1	2	3
48.	SI. Andhra Pradesh	Profile on: Cashew apple processing, Cashewnut processing
49.	SI. Andhra Pradesh	Profile on: Jute stick powder, Jute sutali, Jute twine
50.	SI. Assam	Profile on: Distilled water glucose saline
51.	SI. Bihar	Profile on: Minerals grinding
52.	SI. Bihar	Profile on: MS pipe fittings
53.	SI. Bihar	Profile on: Sodium silicate
54.	SI. Bihar	Profiles on: Cattle feed, Bread making, powerloom cloth, processing Mixed fertiliser
55.	SI. Bihar	Profile on: Hydrated lime
56.	SI. Bihar	Profile on: Cigarette lighter, Glass marble
57.	SI. Bihar	Profile on: Boric Acid
58.	SI. Delhi	Profile on: Sodium dichromate
59.	SI. Gujarat	Profile on: Vanillin
60.	SI. Himachal Pradesh	Profile on: Steel tanks
61.	SI. Maharashtra	Profile on: Maize starch
62.	SI. Orissa	Profile on: Phenyle
63.	SI. Rajasthan	Profile on: Glazed wall tiles, Conduit pipes
64.	SI. Tamilnadu	Profile on: Coconut shell powder
65.	SI. Gujarat	Profile on: Ice plant
66.	SI. Tamilnadu	Profile on: Fishmeal plant
67.	SI. Rajasthan	Profile on: Garlic powder
68.	SI. Maharashtra	Profile on: Tomato products, Fruit processing
69.	SI. Maharashtra	Profile on: G.I Buckets, Ghamelas
70.	SI. Maharashtra	Profiles on: Pharmaceuticals, Monofilament yarn, Oil seed crushing and refining
71.	SI. Maharashtra	Profile on: Asbestos cement pipes
72.	SI. Maharashtra	Profile on: Industrial greases
73.	SI. Maharashtra	Profile on: Copper plating on stainless
74.	SI. Maharashtra	Profiles on: Oxalic acid, Welding electrodes

Note: Con. Consultancy Organisation, GD - Government Department
Ent. - Entrepreneur, SI - Small Industry.

New Products and Processes

CHEMICAL INDUSTRIES

Citronellol from Eucalyptus Citriodora Oil

Perfumes are used as scents in many products, including cosmetics and industrial products like rubber goods and plastics. One of the classes of perfumery synthetics and isolates is represented by the compounds separated from essential oils, like geraniol and linalool. Citronellol, also called 2, 3 - dihydrogeraniol, is used in many heavy and floral perfumes, including rose, geranium and lilac. It is also used in soaps and has been recommended as a component for honey flavours. Rhodinol (levocitronellol) is used to bolster fine quality rose compositions and light florals.

Dried eucalyptus citriodora oil is reacted at 110°C with isopropyl alcohol and aluminium isopropoxide. The acetone formed in the reaction is separated by distillation and the unreacted isopropyl alcohol is distilled off for re-use. The residue is cooled and treated with sulphuric acid. The only layer thus produced is separated and washed with water to get rid of the adhering acid, and then dried on anhydrous sodium sulphate. This product is finally fractionated to give pure citronellol. High boiling essential oil fractions are obtained as by-product. About 100 kg. of the raw material yields 75 kg. of pure citronellol and 20 kg. of residual oil, which can find market in the soap industry.

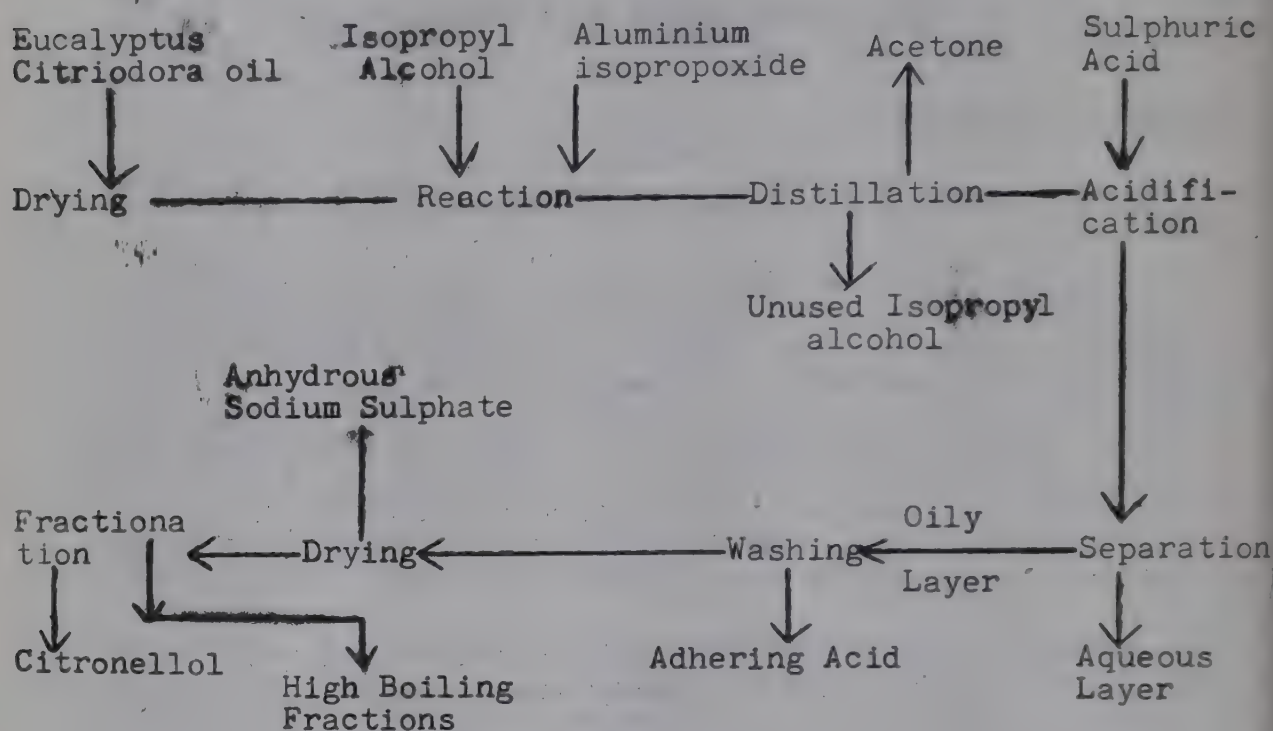
The process was investigated at the Regional Research Laboratory, Jorhat, Assam on a scale of 10 kg. citronellol per day. The same scale of operation has been recommended for a commercial plant.

The main raw materials required for the process are eucalyptus citriodora oil, isopropyl alcohol, aluminium isopropoxide, anhydrous sodium sulphate and sulphuric acid. The major items of equipment required are an all-glass distillation unit fitted with a Dufton Column, a condenser and receiving unit, and a fractionating assembly with vacuum pump and accessories.

A plant producing 10 kg. of citronellol per day (one shift) is considered economically viable. The estimated investment for a plant of this size is Rs.0.2 million (excluding land and building). The land required is 80m² of which 30 m² will be covered area.

For operation, maintenance and supervision of the plant, 10 persons may be required.

Block flow diagram for citronellol from eucalyptus citriodora oil



Electrolytic Iron Powder

Electrolytic iron powder is used in the manufacture of welding electrodes, sintered parts manufacture, flame cutting operations and as reductant in the production of sophisticated chemicals. The demand is met partly by indigenous production and partly by imports. The total requirement for the application mentioned above is estimated to be around 800 tonnes per annum.

The Central Electrochemical Research Institute, Karaikudi, Tamil Nadu has developed a process for the production of electrolytic iron powder. The process consists in electrolysis of ferrous chloride solution in admixture with some additional agents using mild steel anodes and stainless steel cathodes. Every 24 hours the cathodes are lifted, the deposit washed thoroughly, stabilised and iron flakes are removed from the cathode by simple flexing. The chips are ground and classified according to the distribution of particle size required by the consumer. The purity of iron powder obtained is as follows:

Metallic iron	..	92 to 94%
Total	..	96 to 98%

The total capital investment for a plant of capacity 150 kg/day is estimated to be around Rs.4.0 lakhs. The cost of production works out to approximately Rs.650 per kg.

Terms and conditions of release:

Lumpsum	..	Rs.25,000
Recurring royalty	..	2½%
Licence	..	Non-exclusive: 10 years

Lacquer for Leather Finishing

Lacquers are extensively used in the finishing of leathers. Keeping in view their increasing demand, Central Leather Research Institute, Madras has developed a new product 'Lacquer CA' for top cost finishing of leathers. The demand envisaged is 2000 tonnes/year

In the process, film forming resin is mixed with adequate quantity of solvents in a stainless steel vessel and left overnight for soaking and dissolution. The contents are then mixed with solvents, plasticisers, etc. and stirred until a homogeneous mixture is obtained. Thus the lacquer is ready and is packed in containers.

The process has been developed on a pilot plant scale of 150 kg/shift and the product conforms to Indian Standards

The raw materials required for manufacturing the product are resins, solvents and plasticizers and are all indigenously available. The equipment required is a stainless steel vessel with stirring arrangement and can be indigenously fabricated.

A suggested economic unit producing 150 kg/shift (single shift operation only) of Lacquer CA needs an estimated capital investment of Rs.20,000 (equipment along with the electricals, erection, piping, etc. Rs.10,000; working capital Rs.10,000). In addition it requires land of 400 sq.ft for shed and a room of 200 sq.ft. for storing raw materials and finished goods. Manpower required for running the plant are a supervisor with two workers. Cost of the product works out to Rs.20/kg. There is no effluent or pollution.

Manganous Sulphate Monohydrate

Manganous sulphate is used as a micronutrient in agriculture. It also finds use in the production of other manganese compounds employed in pottery glazes, medicine, textile dyeing and printing, and as a fungicide. It is also used as a drier in the preparation of boiled linseed oil.

As a micronutrient, its present demand is estimated at 10-20 lakh tonnes/year. As an essential starting material for the preparation of other manganese compounds, it has considerable export potential. Though India has an abundant availability of manganese ore, there is hardly any production of manganous sulphate in the organised sector, except a few industries producing 1-3 tonnes/day. The current market price of the product is Rs.4,000 per tonne.

Manganese ore is reduced by roasting it along with carbon, coke, fuel oil or natural gas in the temperature range 600-900°C. A rotary kiln or resistance type furnace or multiple hearth furnace is employed. The reduced manganese ore is dissolved in sulphuric acid in the temperature range 70-95°C to get a solution of manganese sulphate. The pH of the solution is maintained at near neutral point to precipitate out the impurities of the heavy metals and other insolubles. The solution obtained is purified and crystallised to obtain solid manganous sulphate. In the laboratory, the product obtained was found to have 99% purity.

Manganese ore (manganese content 35-45% with low iron, SiO_2 , Al_2O_3 , P and S contents and free from heavy metal impurities), Sulphuric acid (commercial), charcoal (75% fixed carbon content) are the raw materials required all of which are available indigenously.

Main equipment - Tumble mill, balance, AC transformer (low voltage and high amperage), 4 PVC-FRP conical bottom tanks of 5000 litres capacity, lead lined pumps, centrifuge (basket suspended type), compressor, evaporator, SS rotary drum drier, etc. All items are available indigenously.

Predesign cost data (basis 330 tonnes/year)

Land and building	Rental
Plant and machinery	Rs.4.47 lakh
Working capital	Rs.2.75 lakh
Cost of production	Rs.3600/tonnes

Status - Investigations on reduction of ore and preparation of pure manganese sulphate solution were carried out on pilot plant scale. Reduction experiments were done in lots of 50 and 100 kg. and leaching experiments in 500 litre batches. Crystallization experiments were done at 3 kg/hr.level using a rotary drum drier. The pilot plant is in operation and could be demonstrated to interested entrepreneurs at the Central Electrochemical Research Institute, Karaikudi, Tamil Nadu.

Synthetic Iron Oxide Black and Red

Iron oxides are widely used as inorganic pigments. Iron oxide red finds extensive application in paints, rubber, tiles, linoleum, inks, flooring etc. iron oxide black is also used as a black pigment and as a magnetic material in flaw detection etc.

Synthetic iron oxide red is being produced in the country by a few firms. However, their production is inadequate to meet the requirement of the country and large quantity of the material is being imported. Table-1 gives the overall figures for all grades (natural and synthetic) of iron oxides put together while Table-2 gives some figures for the synthetic iron oxides.

Table-1

Import figures for iron oxides (all grades put together)

Year	Quantity (kg)	Value (Rs)
1969-70	563000	1131000
1970-71	292000	6505000
1971-72	381000	876000
1972-73	1548000	1572000
1973-74	901300	1632000
1974-75	714000	1584000
1975-76	863000	2180000
1976-77	1404300	3473000
1977-78	855000	842000

Table-2

Some import figures for synthetic iron oxides

1975-76	6600	23139
1976-77	16150	48852
1977-78	20410	126792

With a view to increasing indigenous production of synthetic iron oxides, investigations to develop an indigenous technology were carried out at the Regional Research Laboratory, Bhubaneswar and a suitable process has been developed. The new process involves the addition of milk of lime to the solution of ferrous chloride resulting in the precipitation of ferrous hydroxide. A required quantity of catalyst is then added and air is bubbled into the suspension to oxidise the ferrous hydroxide to magnetic oxide (black oxide) stage. The suspension is filtered. The black oxide residue is washed with water and dried. The process may be terminated at this stage or the black oxide is suitably roasted in presence of air to get the red oxide of iron.

The process has been studied on a bench scale of 250 kg. per batch.

Raw materials required are iron scrap, hydrochloric acid and lime or ferrous chloride liquor and lime. All are available in the country. Ferrous sulphate solutions can also be used with sodium carbonate as the alkali.

The essential items of plant and machinery required are:

1. Dissolution tank; 2. Storage tank; 3. M.S. Stirring tank;
4. Reaction vessels; 5. Centrifuge; 6. Tray drier; 7. Hammer mill; 8. Rotary kiln; 9. Water heater; 10. Pump; 11. Compressor;
12. Testing equipment.

The suggested economic unit for the industry is for the production of 60 tons of synthetic iron oxide black and red per annum. The capital outlay required to put up such a unit has been estimated at Rs.2.35 lakhs. The breakup is as under:

Fixed capital on land and building: rented building at the rate of Rs.300/- month.

Fixed capital Rs.1.75 lakhs

Working capital Rs.60,000

Total capital investment, Rs.2.35 lakhs

The cost of production has been worked out at Rs.4.50 per kg. The return on investment after tax is 25%.

Wash Fast Interlinings

The Ahmedabad Textile Industries Research Association is offering to its members the process know-how for preparing wash fast interlinings, which it has recently developed. This is being offered on a non-exclusive basis, against an one - time payment of Rs.3,000/-.

Three different recipes have been formulated and specifications for the base fabric have also been laid down. The process is one bath process and does not require any special equipment. Also, selection of recipe is as per demand.

Interlining materials are used for making collars and cuffs of shirts, interface of cuffs and overcoats etc. There are many types of interlining materials of which the washfast stiff interlining are more extensively used.

For further information please contact: Shri S.S. Trivedi, Head, Chemical Technology Division, ATIRA, Ahmedabad.

ELECTRONICS AND ELECTRICAL INDUSTRIES

Heterodyne Wave Analyser

A heterodyne wave analyser enables analysis of signals over a wide frequency range with settable bandwidths of analysis. The National Aeronautical Laboratory (NAL), Bangalore, has developed a heterodyne wave analyser which has an analysis range of 2 Hz to 200 Hz with six selectable bandwidths in the range of 3.16 -1000 Hz. The frequency range of 10 Hz to 200 kHz is subdivided into 3 - decade ranges of 2 Hz to 2 kHz, 200 Hz to 20 kHz and 200 Hz to 200 kHz. The frequency is either set manually or under the control of an external voltage. External sweep of the analyser is possible in either a linear or a logarithmic fashion. The analyser also provides a direct mixie display of the selected frequency of analysis.

The magnitude of the spectral component analysed is displayed in a built-in true rms meter. The level can be displayed in volts or as relative dB values. An averaging filter preceding the lin/log convertor of the output enables smoothening of the output spectral component to the desired degree. A separate tracking BFO (beat frequency oscillator) output is also provided whose frequency tracks with the set frequency of the analyser. The control circuits for automatic BT programme selector, a feature useful in random signal analysis, is under development.

The applications of the analyser include, among others: frequency analysis of mechanical vibrations; tracking analysis of mechanical vibrations; tracking analysis of signals from rotating machinery measurement of mechanical impedance, and measurement of frequency response at low levels.

The analyser has the following specifications:

Frequency range	: 2 Hz to 200 kHz in three ranges
Bandwidth of analysis	: 3, 16, 10, 31, 6, 100, 316 & 1000 Hz
Input impedance	: 1 M 3 PF
Meter indication	: 1 mV to 100 V in 10 dB steps
Recorder output	: lin or log outputs
Averaging times	: 0.1, 0.3, 1, 3, 10, 30 & 100s
Set frequency	: upto 200 kHz
Readout	: 5 digital nixie display with 1 Hz or 0.1 Hz resolution
Frequency accuracy	: 0.3% typical
External frequency control	: 0 to 10 V for full-scale sweep.

Self-fusing Rubber Tape

A self-fusing vulcanizing rubber tape developed indigenously comes handy for connecting or splicing electric wires, cables and cords and for repairing or minor mending of trailing cables in mines, P & T cables, electricity board wires, etc.

Developed by Bells Insulation Corporation, Lord Sinha Road, Calcutta, this type of Class B insulation tape is said to have been produced for the first time in the country. The machines used for its production have also been designed by the same firm.

The product is as good as any imported material and covers working temperatures upto 130°C. The tape is so compounded that it gives excellent tack as well as a very high percentage of elongation (300%). Its high elongation value indicates its ability to conform to uneven surfaces and in wrapping tightly.

The physical and electrical properties of tape - like curing period, breaking strength, dielectric breakdown voltage, and elongation - may be better achieved by storing it in a cool place. To give more life to the repair made, a few layers of PVC self-adhesive tape should be wrapped after the vulcanizing job is over.

Solid State Inverter

Solid state inverters are playing very important role as an AC source, where primary power supply is DC such as in railway coaches, air crafts, ship etc. The device can also be used as a no-break AC source in vital installations belonging to industry, communications, defence etc. where even a short interruption in AC power is not permissible.

The device converts 24V DC supply into 230V, 50 Hz single phase AC supply. This is necessary in field conditions or where 230V, 50 Hz single phase supply is required but only 24V DC from secondary batteries is available. A basic 50 Hz oscillator has been built. Two stage transistorised power amplifier increases the power to required level of 500 VA & 1000 VA. Suitable feedback arrangement has been provided to maintain the output voltage with $\pm 5\%$ of 230 volts from no load to full load at the output or against input battery voltage variation.

The Electronics and Radar Development Establishment, Bangalore has designed and fabricated two prototypes, one each of 500 VA and 1000 VA. On testing, the performance has been found satisfactory. The prototypes meet the following specifications:

Input voltage	24 volts ± 1 volt
Output voltage	230 Volts $\pm 5\%$
Load	500 VA and 1000 VA
Frequency	50 Hz ± 2 Hz
Wave form	Sine wave, distortion not greater than 5%
Weight	30.6 kg. for 500 VA, 59 kg. for 1000 VA

The main components required are lamp controlled photo resistor, transistors, diodes, capacitors, resistors, switches, terminals, transformers and mechanical hardware. All the components are available indigenously, except lamp controlled photo resistor which will have to be imported.

The production of inverters requires simple items of equipment such as those needed for welding, cutting, drilling, bending, painting, engraving, soldering. The test instruments required are normal electrical inspection instrument like voltmeter, ammeter, multimeter, oscilloscope. All these are available indigenously.

The investment for a plant capable of producing 50 inverters per annum on one shift per day basis is estimated at Rs.0.2 million, excluding land and buildings.

The plant has a potential to employ six persons for its operation and supervision. This process has not been licensed to any party so far.

Wave and Tide Gauge

A new electronic instrument has been developed indigenously. This oceanographic instrument can be used for measurement of tides and waves in lakes, estuaries, harbours and ocean environments. The instrument has been field tested continuously and operated satisfactorily during the monsoon by National Institute of Oceanography, Goa.

The salient features of the instrument are broad dynamic reliable unattended operation, remote recording and simple installation. The basic instrument comprises of a high resolution, stable, temperature compensated strain guage pressure transducer with associated electronics. The sensed signal after suitable filtering is transmitted via underwater cable to the deck unit recorder kept at a remote place on the shore or an anchored boat. The unit is fabricated in two parts, viz:-

- a) The underwater unit consists of the sensor, associated electronics housed in a brass cylindrical case on a tripod and the cable drum.
- b) The deck unit consists of power supply for the complete unit, signal conditioner suppression range control which enables the user to measure the parameters on a more sensitive scale.

The Wave and Tide Gauge Unit is designed to work on a 12 volt battery. The specifications of the instrument are as follows:

Wave Gauge

Wave Period	:	2.5 sec. to 25 sec.
Wave Height Resolution	:	± 10 cms.
Wave Height Accuracy	:	± 15 cms.
Maximum Depth	:	100 metres can be adjusted for 10 metres and 50 metres
Output	:	Analog voltage 0-5 V full scale

Tide Gauge

Filter Time Constant	:	25 sec.
Resolution	:	± 10 cms.
Accuracy	:	± 15 cms.
Output	:	0 - 5 V full scale (Analog Volt)

The technology development project was funded by Electronics Commission and Electronics Trade and Technology Development Corporation Ltd. (ETTDC) is identifying capable parties in India who would be able to take up the production.

Major potential users in the country shall be the Port Authority of India, Survey of India, Indian Meteorological Department, Andaman Lakshdweep Harbour Work, River Navigation Departments, etc.

ENGINEERING INDUSTRIES

Brick Making Machine

The production of building bricks in the country is far below the demand and the short-fall is likely to increase many folds in the future. The traditional methods of hand moulding cannot cope up with the heavy demand and brick manufacturers are anxious to adopt mechanized methods of production. Fully mechanised imported brick making plants have involved large capital investments. Such plants are beyond the reach of the small scale manufacturers. Semi-mechanised plants, in which only the shaping of the brick is mechanised, require for less capital outlay.

Some engineering firms in the country have marketed pugmills for brick making, catering to the needs of the small producers. Most of these machines are of outmoded design and fail to give satisfactory service. Manufacturers are therefore reluctant to buy these machines.

The large increase in demand for bricks with the anticipated increase in building activity, is a fair measure of the demand for mechanized bricks plants. Already there is an acute shortage of trained moulders which has led to a steep rise in wages, thereby making hand moulding no more compatible with machine moulding.

The machine developed at the Central Building Research Institute (CBRI), Roorkee is capable of producing about 3000 wire cut bricks per hour, with an economically low rate of power consumption. This is in conformity with the capacity of the smallest economic kiln producing about 20,000 bricks per day. It is of an advanced design and can fully satisfy the requirement of the industry both from the point of view of the capital outlay and efficient service.

A full size prototype machine incorporating all the features has been designed, fabricated and commissioned. It has been subjected to intensive trials and has been found successful.

The machine requires parts made of cost iron, mild steel and carbon steel castings, shaft and gears. The blades need to be tipped with hard stellite alloy. Other components like reduction gears, electric motors and vacuum pumps are also required. These are indigenously available.

The plant to fabricate the brick making machine requires usual facilities for castings, machining of parts etc. The facilities include furnace, lathe, drilling machine, and grinder. All these are indigenously available.

A brick making machine having a capacity to produce 3000 bricks per hour is estimated to require an investment of Rs.0.4 million, excluding land and buildings.

The unit can employ about ten persons. The process has been licensed to four parties, two of which are in production.

Citrus Fruit Juice Extractor

Central Food Technological Research Institute, Mysore has developed an improved machine for extracting juice from oranges and other citrus fruits. This machine can fit into any existing fruit juice factory.

It is estimated that the production of citrus fruits in India is about a million tonnes per year. Even if 20% of these fruits are processed for a period of 4 months in a year, about 200 machines of one tonne capacity per hour would be required. The juice obtained is of two grades. The pure juice containing low suspended impurities is ideal for concentration and can be used for making fruit products and confectioneries. The other grade, mixed with slight percentage of peel oil (which can be removed by centrifugation), can be used for preparation of squashes, syrups, etc. The pulp after further extraction of juice is rendered free from essential oils, and used for marmalades or for pectin extract.

The hollow drums having hemispherical depressions to hold oranges are mounted on shafts which rotate in opposite directions, but at the same speed. The fruits are fed in any one of the rows of these hemispherical drums and on rotation the fruits, fed into cups of one of the drums, are enclosed on both sides by the corresponding cups on each drum. On further rotation the fruit is cut into half by a reciprocating knife. Thereafter a set of plungers moves up and squeezes the juice which flows through conveying chutes into collecting vessels. As the drums rotate further, the pulp is discharged through peel discharge chutes.

The juice is collected in two streams. The pure juice free from peel oil enters the plungers through holes and slots. The juice which is extracted from near the skin contains small amounts of peel oil and has no access to the holes in plungers and flows down the outer surface of the plungers and gets collected separately.

Four prototype machines having capacities of 7200 and 10,800 fruits/hr. have been under operation for a long time. Their performance has been found satisfactory.

Materials required to fabricate the equipment are stainless steel sheets, mild steel sheets, structural angles, rods & plates, plates. Other components required are motor, worm type gear box, pumps, power transmission accessories. All these are available indigenously.

The equipment required to manufacture the extractor comprises of general workshop equipment available indigenously.

The fruit juice extractor should preferably be manufactured as an additional item by a unit already in the field. 5 persons can be additionally employed. The design has been licensed to a party, and is in the stage of implementation.

Milling of Pulses

In India pulses (dhals) are in everyday use and form a major dietary constituent of our food, representing about one-third of the total protein intake. By-products from pulses are used mostly in the formulation of cattle feed.

Pulses are generally used in the dehusked split (dhal) form, either cooked or powdered. About 12 to 13 million tonnes of various types of pulses are produced annually in India and most of these have to be milled before consumption. The production of pulses is expected to increase in the coming years with the introduction of improved varieties and may reach a target of 20 million tonnes per annum.

At present most of the pulses in India are being processed by conventional wet or dry methods which are generally laborious, time consuming and highly wasteful.

Central Food Technological Research Institute (CFTRI), Mysore has designed a milling plant for pulses incorporating improved technique. The plant has the facilities for loosening the husk from the grains, removing husk in a specially designed dehusking machine (pearler), separating dhal from the dehusked material, polishing and bagging. The round grains obtained can be polished and bagged as such or can be split, polished and bagged, if desired. The powder and husk obtained as by-products are ideally suited for cattle feed manufacture.

The milling machine has been operated on a bench-scale using 1 to 3 quintals of pulses per batch. The end products obtained were of high quality with good cooking characteristics and high consumer acceptability. With this machine better quality products can be obtained with considerable ease even from inferior raw materials which are difficult to process by traditional methods. The aroma and taste of dhals obtained have been found to be very good.

A semi-automatic pilot plant having a capacity of 5-7 quintals per hour has been set up. The pilot plant has been successfully demonstrated to about 100 representative dhal millers from all over the country. In all about 50 tonnes of dhals (Arhar and small quantities of other pulses) have been produced by the Institute using this machine in batches of 5 to 25 quintals.

The milling plant needs the following units: cleaning and grading sieve unit with motor; conditioning unit; tempering bins; pulse pearler; aspirator-cum-sieve; dhal separator-cum-grading sieve; water mixers; tempering pad or shelves; lump breaker; pulse splitter and bucket elevators.

All the units can be fabricated in India and no imports are necessary.

The units which comprise the milling plant for pulses are given above. The units will have to be got fabricated from local manufacturers. The equipment required will mainly be for fabrication of small parts and assembly, for which a well-equipped workshop will serve the purpose.

The investment required for the fabrication of small parts and the assembly would not be much. However, setting up of a plant having a capacity to process one tonne of dhal per hour is estimated to cost Rs.0.7 million.

The dhal milling plant has a potential to employ about eight persons. The know-how has been licensed to two parties and both the mills are in production.

New Machinery and Equipment

AGRICULTURAL MACHINERY

Circular Type Chaff Cutter

With the growing need for the conservation of fodder, it has been realised by all the farmers to have a mechanical contrivance for cutting their valuable fodder into small pieces such that atleast 90% of the feed is consumed by cattle. Older practice of cutting longer pieces lead to waste of the scarce materials. Hence with the object of helping the agriculturists and cattle farms, a circular type power driven chaff cutter has been designed and developed which can cut jowar fodder, as well as the green stalks of raghi stiff grass and other similar stuff including tender cotton stems.

Construction: The head of the machine is made of cast iron with feed rollers to feed the fodder continuously into the chopping table where two steel blades fixed on to the fly wheel diagonally opposite to each rotate on the main shaft driven by power at the end.

Feed Rolls: These are made of cast iron with triangular spikes to hold and push the fed-material gradually into the chopping table.

Worm & Pinion: To drive the feed rolls in relation to the fly wheel so as to feed about $3/4"$ to be cut by the blades successively, suitable worm and pinions are provided at the head.

Frame: The head is fixed on the frame made of M.S. Angles with stand, together with the main shaft and the driven pulley. A suitable base plate is provided at the top to hold the electric motor.

Mech.Data

R.P.M.	:	175
No. of Blades	:	2
H.P. Rqd.	:	1 to 2
Output	:	Depends upon speed of hand feeding
Base	:	May be fixed on foundation bolts.

Details from: Elseetee Industries, Trichy Road,
Coimbatore-641005, India.

Groundnut Decorticator

The frame is made of welded M.S. angles. The cast iron hexagonal cylinder is machined and balanced before assembly and is fitted with smooth rubber pads. This reduces the breakage of seeds to bare minimum. After attaining the required speed of about 150 RPM, the cylinder gains momentum requiring only a lesser operational power.

Shelling Chamber: This is a sheet metal case with a provision to hold a sieve that helps breaking of the shell. The shelled nuts fall on the gutter below and slides down to the receptacle or a basket. There is a built-in breezer to blow away the broken shells and dust, and to clean the seeds.

Manual Operation: A set of hobbled gear and pinion is provided with a cranking motion on the gear connected to a pedal through a lever. When the pedal is pushed down it contrives to revolve the gear and gradually gives the pinion on the cylinder shaft to attain the required speed.

Power Driven: The machine can be driven by a 0.5 HP electric motor or a gas engine. In this type there is no gear and pinion but the cylinder shaft is directly driven by the prime mover.

Sieves: Two steel sieves are supplied along with the machine with different sizes of slots. Additional sieves of different sizes of slots can be supplied on specific orders.

Cap: 3 bags per hour approx.

Further details from: LCT Elseetee Industries, Trichy Road, Singanallur, Coimbatore-641005.

Potato Grading Machine

Based on experience gained in the country's main potato-growing areas, a British company has introduced an electrically powered grading machine which grades potatoes into sizes quickly but gently.

The Tong range of four graders features extensive use of rubber on many parts to protect the potatoes against damage.

Each model of the grading machinery is mounted on a chassis fitted with two pneumatic wheels and a tractor drawbar to facilitate movement.

The basic principle of the machines is that the potatoes are fed on to the grader by an elevator and then moved by an endless belt conveyor to a gently agitating screen through which the undersized potatoes and dirt fall. The screen is also an endless belt conveyor which takes the potatoes to another belt or roller conveyor which moves them to a bagging or loading point.

Soil extractors fitted immediately in front of the fed elevator are capable of removing large quantities of soil and loose stones before they reach the screen.

The soil extractor is fitted with a chute under the chain links to convey unwanted material to one side of the machine, so eliminating a build-up of deposit underneath the machine.

The basic machine is available with a 610 mm (2 ft) wide screen for outputs of 5 tonnes/hr, or a 915 mm (3 ft) wide screen for outputs of up to 20 tonnes/hr. Screens are available from 19 mm (3/4 in) to 89 mm. (3 1/2 in).

Manufacturers: E.J. Tong & Sons, (Engineering) Ltd, Spilsby, Lincolnshire, England.

CHEMICAL PROCESS EQUIPMENT

Batch Alkali Refining, Bleaching and Deodorising of Oils and Fats

Fats and oils are basic food materials. They are the most concentrated source of energy in the human food yielding about 9.3 cal. per gram as compared to 4 to 5 cal. per gram for proteins or carbohydrates. They are also important as a source of oil soluble vitamins and of certain essential unsaturated fatty acids.

Fats and oils are also used in huge quantities for technical and non-edible purposes. They are the basic constituents of many surface coating (paint, printing ink, varnish and drying oil), soaps and synthetic detergents, emulsifiers, lubricants and fatty acids. Fatty acids alone are used in the production of hundreds of technical products including facial creams and other cosmetics, in balancing rubber and rubber compounding etc.

Chemically, fats and oils consist of mixtures of different triglycerides (esters of glycerol, both saturated and unsaturated fatty acids). Crude fats and oils produced by heat rendering expressed or solvent extracted contain variable amounts of non-glyceride impurities.

Not all impurities in crude oils are undesirable. The sterols are colourless heat stable and for all practical purposes inert, hence they pass unnoticed unless present in usually large amounts. Tocopherols perform the important function of protecting the oil from oxidation. Most of the other impurities are objectionable since they render the oil coloured, cause it to form or smoke in the frying pan, These are precipitated when the oil is heated in subsequent processing operation. The object of refining is to remove the objectionable impurities in the oil with the least possible damage to either the glyceride or the tocopherols or other desirable impurities and with the least possible loss of oil.

The term "refining" refers to any purifying treatment designed to remove free fatty acids, phosphates or mucilagenous material or other gross impurities in the oil. It excludes, "Bleaching" and also "Deodorisation".

They are many methods of refining oils, "Kettle" or Batch, Continuous and physical refining.

Batch Refining by Caustic Soda

The most important and useful method for refining crude oils is by treatment with alkali. Alkali refining almost completely reduces the free fatty acid in the oil (0.01 to 0.03%) by converting them into oil-insoluble soaps.

Design of DE Smet Neutraliser

De Smet design of neutraliser is controlling the minimum loss of oil during neutralising. It consists of robust built cylindrical shell bodies with steep conical bottom in M.S. construction equipped with adequate steam heating coils or steam jacketed and stirrer with variable speed drive, motor and gearbox. There are several atomisers fitted at the top of neutraliser for proper dispersing of caustic lye and hot water for water washing. The neutraliser capacity is designed for processing oil and fats with higher free fatty acid (which would need larger volume of caustic lye) for quicker heating of charge to desired temperature and for effective separation of soap stock. Motor gearbox are fitted to suit continuous rating and gives trouble-free life-long service. De Smet is in position to design neutralisers from 1 ton to 30 tons.

Process

De Smet batch refining equipment also consists of caustic dissolving tank, caustic service tank, hot water tank, brine water tank, soap stock tank, water wash tank with necessary pumps, pipes, valves including temperature gauges.

The crude oil to be neutralised is first pumped to the neutraliser to the pre-determined level which is substantially higher than top level of heating coil. The charge is then stirred thoroughly and sample is drawn for acidity test.

The steam heating of oil charge is commenced while the charge is under vigorous agitation and heating is discontinued until desired temperature is reached. The predetermined quantity (depending upon acidity of oil) is added by atomisers into the oil charge while oil is under agitation. Soon after adding caustic lye the rate of agitation is reduced and agitation is continued till soap stock are formed and this stage is technically known as "Break". The charge is then allowed to settle for 2 to 4 hours depending upon volume of charge and nature of break obtained. Usually 20 to 30% excess caustic lye is required over and above the theoretical quantity to obtain desired break.

At the end of settling period the soap stock is withdrawn from the bottom of neutraliser (NTR) into soap stock tank. After complete draining of soap stock bottom AV is closed.

The neutralised oil is then given repeated hot water washes without agitation of oil and batch is allowed to settle for an hour and water is drained into wash washer tank (WWT). Brine water wash is also done in the same circumstances and under normal conditions as in hot water wash. Now the neutralised and washed oil is ready for transfer to bleacher.

(B) De Smet Batch Bleaching

Fats and oils are processed by bleaching to remove undesirable colouring matter remaining after alkali refining.

The bleaching earths and carbons which are used for bleaching possess the power to absorb not only colouring matter but also colloiddally suspended gums, resin soap and certain degradation product that may not have been removed during alkali refining. De Smet Bleaching system is especially recommended for non-traditional oils/fats also for highly coloured oils/fats, besides being suitable for small capacity installations.

Bleaching is a physicochemical process where the alpha and beta carotenoid pigments indigenous to the oil are removed or reduced substantially by the bleaching agents under optimum conditions of temperature and agitation. To prevent oxidation of oil, the bleaching as well as the dehydration of oil which is a prerequisite, are carried out under vacuum. Activated fullers earth with or without activated carbon constitute the bleaching agents which are introduced into the De Smet Bleacher with the aid of vacuum suction at the appropriate stage and the quality of bleaching agents introduced depends on the type of oil charge the colour of oil charge and the extent of bleaching required consistent with economics of this operation.

Some stubborn colours, brownish colouring matter consisting of organic degradation products mainly originating from degraded proteins and carbohydrates and mucilgeneous matter are encountered in oils derived from old and damaged oil bearing materials and these colours are relatively difficult to bleach, but with the flexibility of operating system even this 'stubborn colouring matter is also effectively removed.

De Smet Batch Bleacher is in M.S. construction cylindrical in shell top and bottom dishes, with common heating and cooling coil, agitator, sight and light glasses, motor and gearboxes, The detailed specifications are as under:

Material Construction: IS 226

Body Style : Cylindrical shell top and bottom dish end.

Steam Coil : Common heating and cooling coil will be provided having sufficient heating surface area of IS 1239 heavy gauge pipe.

De Smet Bleacher is provided with agitator with shaft sealing, free from any air leakage into the system for maintaining vacuum inside. Bleacher will be provided with all necessary nozzles for oil inlet, oil outlet, steam inlet, condensate outlet, vacuum, sampler and pocket for thermometer and for adding the bleaching earth.

De Smet Batch Bleaching Process

De Smet Batch bleaching system provides for charging the bleacher either by vacuum suction direct from De Smet batch neutraliser or by pump and the choice of vacuum equipment (steam ejector or vacuum pump) depends upon particular needs of each installation consistent with power and steam supplies existing in the installation.

The neutralised oil is heated to suitable temperature under continuous agitating and when desired temperature is achieved a mixture of bleaching earth and carbon is added and agitation under vacuum is continued for 20/30 minutes.

The quantities of bleaching agents to be used are infinitely variable depending on needs of each charge of oil/fat and similarly bleaching period is also infinitely variable.

Oil is withdrawn from the sampler of batch bleacher for laboratory test. When the desired colour is achieved the oil is cooled to the filtration temperature for filtration.

Filtration of the charge can be carried out by special filter presses or to the filter presses of C.I. construction plate and frame type.

Convenient location of controls and instruments makes operation of De Smet Batch bleaching system easy and the system can be handled by comparatively less skilled operation.

(C) De Smet Batch Deodorising

Although De Smet (II) brought the concept of continuous deodorising to the country which is ideal for larger installations, batch deodorising system for installation of 20 tons/day or less capacity is recommended. For smaller capacity installation, De Smet Batch deodorising system affords the same economics of steam consumption as that to be obtained when continuous system is adopted for small capacities while on the other hand De Smet batch deodorising system needs comparatively less capital investment.

De Smet batch deodorisers incorporate decades of global experience i.e. knowhow of highest order available in the deodorising technology ensuring decade of trouble-free service. The design provides for adequate heating surface area of heating coils to raise the temperature of oil/fat charge to the desired temperature as quickly as desirable, with the arrangement of stripping steam injection, instrumentation facilities, and economy of steam consumption. Deodorisation operation is substantially reduced by agitation of the charge by special distribution of stripping injection steam under very high vacuum 6 to 9 mm. maintained with De Smet multistage steam ejector system.

The equipment is supplied with entrainment separator, barometric condenser, steam ejectors, boosters, sampling arrangement, necessary instruments and special light fittings for deodoriser.

De Smet Batch Deodoriser system is also provided with a heat exchanger/cooler where the entire deodorised oil charge could be dropped under vacuum to the cooler. The cooler thus helps to augment the deodoriser capacity. Economy in steam consumption can be achieved in De Smet Heat Exchanger by cooling the hot deodorised oil by incoming fresh charge of bleached oil to the deodoriser through heat exchanger.

De Smet Cooler/heat exchanger is provided with agitator with proper shaft seal ensuring total freedom from air leakage into the system thus ensuring well deodorised bland product.

Details from: De Smet (India) Pvt. Ltd. Shree Niketan,
Shiv Sagar Estate, Post Box No. 16582, Bombay-400018.

ELECTRONICS AND ELECTRICAL EQUIPMENT

Dew Point Meter

A dew point meter checks the water content of a wide range of products, before packaging, in storage or at retail outlets. It provides efficient quality control for foodstuffs, tobacco, pharmaceuticals and cosmetics, seeds, etc. Housed in an alloy cylinder, the unit's 40 mm dia. x 50 mm high sensor incorporates an electrically cooled solid gold mirror to detect optically the dew point temperature from which the water content of a product can be easily calculated. The sensor can be changed easily and is unaffected by light and humidity. Connected by a cable, the sensor may be kept several metres away from the instrument. Measuring accuracy is maintained by an electronic circuitry, even under extreme conditions. Three push-buttons provide for scale readings of dew-point temperatures (from 0°C to 40°C), relative humidities, and ambient temperatures. Three lamps give at-a-glance indication of the state of the meter. Optional modules are supplied to provide signals for operating control and alarm units. Details from: Protimeter Ltd. Meter House, Fieldhouse Lane, Marlow, Buckinghamshire, England.

Photocell Controls

Hakotronics Photocell Controls are light-operated controls. A photocell detects the presence of a beam of light, and actuates a relay to control the external circuit.

Features

- . Versatile, proven sensitive circuitry
- . Superior long term accuracy, stability, reliability
- . Remote indication, monitoring, alarm, control, totalizing recording, comparing
- . Twilight switches, flame failure detection, batch counting, level detection, stop motion
- . Digital read-outs.

1. **Twilight Switches:** Street lights, compound lights, etc. can be turned on automatically at sun-set and turned off at dawn, in summer and winter and undisturbed by power frequency variations.

2. **Flame Failure:** Hakotronics photocell controls are used by boiler manufacturers to monitor pilot gas flame. The photocell, mounted suitably, continuously monitors the presence of flame, and gives an alarm in case of flame failure. These controls are used in oil burning equipment and furnaces etc.

3. Alarms: Hakotronics photocell controls are used in battery manufacturing machines: if flow of parts on the conveyer is interrupted, the machine is shut off and an alarm is given. Similarly, they are used as burglar alarms, automatic lift door openers and in automatic lifts, to provide safety interlock on machinery such as power presses, injection-moulding machines etc.

Technical Specifications:

Operating Voltage: 230 V, AC, 50 cps; $\pm 10\%$
Input signal: ambient or external visible light
Pick-up: Cds Cell; others optional
Sensitivity: adjustable
time delay : optional
Max. counting rate: from 10/sec. to 10,000/sec.
Max. count: 999,999

4. Counting Objects: Hakotronics photocontrols are used to count the number of objects: e.g. articles passing on a conveyer belt, people passing through a door, etc. An additional attachment also gives an alarm when the pre-set count is reached.

5. There are many more applications of Hakotronics Photocell Controls, limited only by imagination of the user. These are used as yarn breakage detectors, seam detectors, level detectors, level controls, contactless limit switches, to operate cutters on packing machines, etc.

All the above controls can be supplied with additional circuitry such as time delays to provide a completely interlocking controls system for any type of application. It is also possible to use more than one photocell with a single control unit.

Details from: Hakotronics Private Limited, Sussex Road, Bombay-400027 DD, India.

Signal Generator

Marconi AM/FM signal generator covers the frequency range 10 KHz to 120 MHz in 12 switched banks. Fundamental frequency operation is by voltage tuned oscillators, which, in conjunction with panel mounted controls, enable easy tuning to narrow band communication receivers upto the highest carrier frequencies.

Both amplitude and frequency modulation can be derived from an internal oscillator. The depth is variable upto 100 percent by a directly calibrated control. FM is directly calibrated in three full scale ranges of 5 KHz, 25 KHz and 75 KHz. External modulation can also be supplied and a combined a.m. and f.m. facility is also available.

The instrument, which is compact and portable, can be operated from an a.c. mains supply or from an external battery.

For further details contact: Aimil Sales and Agencies Pvt. Ltd,
India House, Walchand Hirachand Marg, P.O. Box 119, Bombay-400001

re

PACKAGING MACHINERY

Corrugated Board Printer

To print directly on corrugated boards without damaging flutes.

- . Prints through rubber stereotypes using letter press ink
- . Flawless and distinct impression. Instant drying
- . Easy operation and maintenance. Easy accessibility for cleaning rolls
- . Simple and quick set up
- . Uniform spreading and controlled flow of ink
- . through a series of large rubberised rolls
- . Economical for small lot printing
- . Lateral and longitudinal registration control on double colour printing machine for perfect registration between colours.

Standard Specification

Board size	Minimum	Maximum
Length	15 in.	48 in.
Width	10 in.	72 in.
Thickness	3 Ply	7 Ply
Floor area	Single	Double
Length	14 Feet	18 Feet
Width	9 ½ feet	10 feet
Net Weight		
Approximate	15 tons	2.25 tons
Output Auto-manual variable speed drive provided to very speed	Single colour 500 to 1200	Double colour 500 to 1200
Power-Motor Ac/3 phase/440 Volts/50 cycles	3 HP	5 HP

Further details from: Technopak Engineering Company,
C-105, Industrial Estate, Rajajinagar, Bangalore-44.

Flexographic Rotary Printing Machine

To print on board and paper in multicolours, Technopak Engineering Company has manufactured Rotoprint machine for web widths ranging from 252 to 1250 mm, giving an optimum output of 50 metres per minute.

Frame: Rugged stress relieved cast iron frames, console plates and slide brackets machined accurately.

Inking System: Ink tubs made from heavy gauge brass sheet and provided with drain cocks.

Fountain and transfer rollers moulded with neoprene rubber and perfectly ground.

Ball bearings provided on rollers for smooth running.

Adjustable knobs for control of flow of ink and even transfer of ink to the rubber stereo.

Printing cylinders are made from seamless pipes, perfectly machined and graduated for easy location of stereo.

Machine is designed to accomodate cylinders with repeat lengths ranging from 20 to 75 centimeters.

Registration Control: Manually operated registration control system is provided for perfect registration between colours.

Unwinding Unit: Mechanism provided for lateral adjustment of web during operation retaining tension. Friction brake arrangement is incorporated for maintaining constant tension of web.

Web passes under spring loaded dancing roller for accommodating slackness of web.

Rewinding Unit: Surface rewinding mechanism for uniform web velocity throughout the buildup of beam and compact winding. Collapsible shaft for quick and easy insertion alignment and extraction.

Drive: Manually operated variable speed drive affords varying speeds.

Output: Ranging from 20 to 60 meters per minute.

Details from: Technopak Engineering Company, Bangalore.

Gummed Paper Tapes

The complete plant for manufacture of gummed paper tapes consists of: Glue Preparation Tank, Glue Coating Machine, Slitting-cum-Rewinding Machine and Printing machine.

Glue Preparation Tank

Specification

Circular glue tank fabricated out of heavy gauge mild steel plate
Glue tank jacketed Oil tank
Valves type agitator running at low speed.
Drain cock provided
Open type electric air heaters - 9 KW capacity
Agitator driven by motor 3 HP/AC/3 phase/440 volts/50 cycles
Capacity - 200 kg.

Glue Coating Machine

Reel to reel automatic single side glue coating machine for kraft paper:

Specification

Thickness of kraft paper - 40 to 60 gsm.
Maximum unwind reel diameter - 24"
Maximum width of paper - 30"
Maximum rewind reel diameter - 20"
Inside diameter of core - 3"
Inside rewind core dia - 3"

Features

Unwind Unit

Threaded spindle with cones and jacknuts
Spring loaded positive geared friction clutch
Arrangement for uniform tension of paper
Manually operated web centering arrangement
Dancing roller for accommodating slackness in web.

Coating Assembly

Mild steel fabricated coating tank-jacketed with oil tank oil immersion heater of 1.5 kw capacity for heating oil
Coating roller made out of seamless pipe, duly machined ground supported by heavy duty ball bearings.
Transfer roller made from mild steel seamless pipe with nitrile rubber duly ground, runs on ball bearings
Flow of glue can be controlled by means of handles
Thickness of coating of paper can also be controlled to very close precision.

Main frames are made of closely grained stress relieved machined cast iron and held together rigidly by means of heavy cross supports
Lifting and lowering arrangement for glue tank by means of rack and pinions
Diverting heated roller for heating rear side of paper.
Air heater of 1.5 kw capacity.

Drying Bridge

Drying bridge is fabricated out of MS channels and angles forming an arc
Guide rollers made out of seamless pipe machined and supported by ball bearings and driven by sprockets and chain
Tabular air heater of 30 kw capacity provided with reflectors for effective drying of gum on paper.

Rewind Mechanism

Twin drum surface rewind mechanism is provided to maintain uniform surface speed of paper throughout build up of rewind reel and to obtain tightly wound reels. The drums are made out of mild steel seamless pipes duty machined.
Rewind spindle of 50 mm diameter duly threaded and provided with cores and jacknuts
Rewind system is driven by a motor of 5 HP/AC/3 Ph 440 Volts/1440 RPM/50 cycles with stepless automanual variable speed drive to vary speed of paper from 5 to 15 meters per minute.

Control Panel

Control panel fabricated out of MS angle and sheets elegantly designed, consisting of:

- Main switch for the entire electric system
- Switch for motor
- Switch for air heater of diverting roller
- Switch for oil immersion heater of the coating pan
- Gang switch for tubular air heaters provided on the bridge
- Indicator lights for:
 - Main switch
 - Each gang of tubular heaters on the bridge
 - Oil immersion heater

Slitting Gum Rewinding Machine

For slitting of kraft paper from reel to reel

Specification

Thickness of kraft paper - 40 to 60 gsm
Maximum width of paper - 30"
Narrowest width of paper after slitting - 3/4"
Maximum diameter of rewind - 9"
Inside diameter of core of parent reel - 3"
Inside diameter of rewind core - 1"
10 sets of male and female cutters will be provided with the machine
Additional cutters and spacers can be supplied at extra cost.

Features

Main frames made from closely grained stress relieved cast iron duly machined and held together by means of heavy cross supports
All guide rollers made from seamless pipes precision machined and run on ball bearings
Dancing roller for accommodating slackness in web
Surface rewinding mechanism for tightly wound rewind reel
Rear surface rewinding roller duly nitrile rubberised and ground
Top pressure roller for rewinding for compact winding and to avoid interleaving
Female cutters are made from special alloy steel hardened and ground
Spring loaded self locking male cutters made from special alloy steel hardened and ground for long life
Quick disengaging arrangement for top cutter assembly
Machine is driven by a motor of 1 HP/AC/3Ph/440 volts/ 50 Cycles

Flexographic Reel to Reel Double Colour Printing Machine

Specification

Thickness of paper - 40 to 60 gsm
Maximum width of paper - 4"
Narrowest width of paper - 3/4"
Maximum unwind reel diameter - 9"
Maximum rewind reel diameter - 9"
Inside core diameter of unwind and rewind reel - 1"
Number of colours - 2"
Range of repeat length of printing - 6" to 12"

Features

The printing unit is mounted on mild steel fabricated table
Body is made from closely grained cast iron stress relieved
and machined

Inking and transfer rollers are moulded with nitrile rubber
and ground

Ink tubs fabricated from heavy gauge brass sheet

Inking and transfer rollers are adjustable for control of
flow of ink

One pair of printing cylinders of the repeat length required
will be provided on the machine

Additional printing cylinders for different repeat lengths
can be supplied at extra cost.

Machine is driven by motor of $\frac{1}{2}$ HP AC/3 phase/440 Volts/
50 cycles.

Further information from: Technopak Engineering Company,
C-105, Industrial Estate, Rajajinagar, Bangalore-560044.

Industry Roundup

This section highlights policies and procedures, guidelines, the present status and future prospects in certain industries as well as the latest available data in respect of such industries.

STARCH INDUSTRY IN INDIA

Introduction

Starch is one of the most common substances existing in nature and is the major basic constituent of the average diet. Being the reserve carbohydrate of plants, it is widely distributed in nature. Starch has a wide range of applications. Its industrial applications are numerous, being used in more than 300 modern industries including the manufacture of textiles, paper, food adhesives, insecticides, paints, soaps, explosives and such derivatives as dextrins, nitro starch and corn sugar. It is also an important starting raw material for a number of organic chemicals.

Historical

As early as 3500 B.C. man was using starch in manufacturing paper (as an adhesive and stiffener). The Egyptians around this period cemented papyrus together with the help of starch. During the period 700-1300 A.D. paper was given a heavy coating of starch but this practice was somehow discontinued since the 14th century and was only revived in our modern era.

The Middle Ages saw the use of starch in the textiles for the first time as a common stiffening agent. By 1744, the English were using it in sizing and warp glazing. The discovery made by kirchhoff with respect to glucose and the thinning of starches by enzymatic action in the beginning of 19th century gave great impetus to starch manufacture through the increased areas of application which the above two created.

Manufacturing Process

The corn (maize) kernel consists of 11-20% water, with the following average constituents, expressed in percentage:

Moisture	16.0	Oil	3.8
Starch	61.0	Fibre	2.0
Proteins	9.0	Sugars	1.6
Pentosans	5.3	Ash	1.3

On the above basis, 1 bu (0.8 cuft) of corn yields approximately 30.8 lb of starch, 23.5 lb of by-products (gluten meal, corn bran, germ-oil, and steep water), and 1.7 lb. of corn oil.

In the wet milling process, for the extraction of starch the starch granules in the corn are loosened and then separated from protein, fibre and other substances, collected by centrifugation and finally flash dried.

The cereal is first softened by steeping in water for 30-50 hours at 48°-52°C in the presence of SO₂ (0.125% concentration) and lactic acid. The presence of SO₂ not only inhibits the growth of putrefactive organism but also helps in the removal of protein. Sulphur dioxide dissolved in water forms an equilibrium mixture of hydrogen ions and bisulphite ions. Bisulphite ions reduce the disulphide bonds that cross link protein strands, resulting in the formation of protein theosulphate which is more soluble in water.

Steeping at 45-55°C favours development of lactic acid bacteria. The lactic acid produced lowers the pH of the medium and restricts growth of other organisms. It also softens the cell wall of the corn.

After steeping, the grains are coarsely ground in an attrition mill. Starch is separated from protein and oil rich 'germ' in a hydroclone separator taking advantage of difference in densities. The bulk of the free starch is screened from the coarser particles. Starch remaining in horny endosperm is released by a more thorough milling technique. The starch released by milling is separated from fibres by screening, from gluten by settling or centrifugation. The starch is then washed several times in hydroclones, centrifuged and then finally flash dried.

Raw Materials - Availability and Price

The main raw materials for starch in India, is maize or tapioca. Most large scale units need maize as the raw material. Maize is a coarse grain extensively used as a food grain in India. Thus the starch industry requirement of maize is in direct competition with the demand generating from the economically weaker sections, more so when there is a supply constraint. Also the supply of maize has been very erratic, showing year to year fluctuations. This coupled with restrictions on interzonal movements creates acute problems of raw material supply. At present about 70% of the installed capacity in the starch industry is outside the important maize growing areas.

In the sixties, the starch industry had less raw material problems as maize was being imported from the U.S. under PL 480 programmes at reasonable rates. The prices of maize have since gone up significantly, resulting in escalation of raw material cost thereby making maize starch more, expensive and less competitive vis-a-vis tapioca starch and other substitutes.

Tapioca starch is principally manufactured in Kerala and Tamil Nadu as they are prominent tapioca producing areas. The production rate of tapioca in the two states is estimated at 5 million tonnes per annum, thus offering a good scope for further development of the tapioca starch industry. Tapioca starch, however, is not a perfect substitute for maize starch in all the end uses.

Starch Industry in India

The cotton textiles industry is the chief end user of starch in India. However, the starch industry is relatively young as compared to the cotton textiles industry, because until the second world war, starch was being imported from countries like U.S., Australia, U.K., the Netherlands etc. The post war saw many difficulties in getting starch supply from overseas sources. This necessitated the beginning of the starch industry to become self reliant.

The first two units were established in Gujarat in 1939 and 1941 - M/s. Anil Starch Products Limited and M/s. Hindustan Chemicals and Colour Company Limited (now known as Maize Products) respectively. Subsequently many units came up and quite a few of them disappeared but during the past 25 years these two units have progressed satisfactorily.

At present there are 10 units in the organised sector with a combined installed capacity of 225600 tonnes.

Table 1 provides information on the number of units, installed capacity and production of starch in the organised sector in India from 1967-1978.

Table 1

No. of Units, Installed Capacity and Production of Starch
in the Organised Sector from 1967-1978

Year	No. of units	Installed Capacity (000 tonnes)	Production	
			Quantity (000 tonnes)	Value (million rupees)
1967	8	188.50	74.00	74.00
1968	8	205.50	97.00	97.00
1969	8	205.50	107.80	110.50
1970	9	168.60	78.80	81.21
1971	9	168.60	98.20	NA
1972	9	168.60	105.60	NA
1973	9	168.60	80.00	NA
1974	9	168.60	89.80	271.50
1975	9	168.60	75.00	225.00
1976	9	168.60	110.00	250.00
1977	10	225.58	126.54	279.00
1978	10	225.58	130.69	312.70

The installed capacity in the starch industry has remained stagnant at around 168000 tonnes during the period 1967-1975. The production of starch displays an erratic trend during the period under consideration, being 74000 tonnes in 1967 and showing the highest production of 108,000 tonnes in 1969. In later years also it has shown irregular variations. The capacity utilization in the industry has remained fairly low at around 50%, throughout the period. Year to year changes in the availability and price of maize - the principal raw material - is the main factor for this performance of the industry.

From table 1 by comparison we find that in terms of value, the production has increased more than four times during the period 1967-1978, thus showing that there is a significant rise in the unit value of the product over the years. But this partly reflects the escalation cost of production and higher input costs over the years.

Structure of the Industry

As mentioned earlier, there are 10 units in the organised sector manufacturing starch. Table 2 provides information on capacity and production of the major units in the industry.

Table 2

Capacity and Production of the Major Units in the Starch Industry

Name of Unit	Location	Installed Capacity (Tonnes/ annum)	Year	Production (Tonnes)
Anil Starch & Chemicals Limited	Ahmedabad, Gujarat	60,000		N.A.
Maize Products (A division of Sayaji Mills Ltd)	Ahmedabad, Gujarat	95,000	April '75- March '76	19,280
Laxmi Starch Ltd.	Hyderabad A.P.	30,000	April '70- March '76	16,719
Bharat Starch Ltd.	Jagadhari, Haryana	12,600	Jan - Dec '76	6,711
Sukhjit Starch & Chemicals Ltd.	Bhagwara, Haryana	16,500	Jan - Dec. '76	9,381
Rajaram Brothers	M.P.	7,500	--	N.A.

Demand for Starch

As discussed earlier, starch is used in a number of industries for various purposes. In the textile industry, it is used for sizing and finishing. It is used as the starting raw material for making dextrose and liquid glucose. It is also applied in the food industry to make a variety of products, as also in paper and jute industries. Some of the major end uses of starch are discussed in the following paragraphs.

1. Textile Industry

In India, the principal end use of starch is in the textile industry which accounts for about 65% of the total starch consumed annually. It is mainly used in the process of sizing by which a good wearing performance is ensured to the yarn. Maize starch is preferred to tapioca starch in the process of sizing because the uniform viscosity of maize starch results in a uniform and even - spread and a uniform penetration into the interstices of the yarn, thus not affecting the thinness or thickness of the yarn. To a lesser extent, it is also used in the operation of finishing, a process by which changes in the stiffness of the cloth can be effected.

2. Dextrose and Liquid Glucose

Dextrose and liquid glucose are manufactured by partial or complete hydrolysis of starch under highly controlled conditions. In India this is the second major application consuming about 20% of the total starch consumption per annum.

3. Paper Industry

Starch is used in the paper industry primarily to increase the strength and stiffness of the paper. Besides, it imparts other qualities to paper like brightness, erasibility and poor ink penetration. The paper industry in India accounts for about 10% of the total annual starch demand.

4. Food Industry

Starch is used in the food industry to give a special texture to many foods. In particular, maize starch is used for thickening sauces, puddings etc.

Future Demand

The demand for starch is a derived demand depending upon such factors as growth and development of the end-use industries. Future demand for starch will principally depend on the following two factors.

1. Raw Materials: availability and price
- ii. Growth and development of the end-use industries

The first of the two factors has been already discussed earlier.

As for the second factor, the demand for starch is primarily dependent on the performance of those industries, where the main products are textiles, dextrose, liquid glucose and other hydrolysis products, paper and food products.

Although the textile industry consumes about 60% of the total starch produced in the country, its growth has been very slow in recent years. Production of dextrose and liquid glucose has not increased according to expectations and in fact, there has been considerable under-utilization of capacity in the industry. Dextrose production has remained stagnant at 11000 tonnes per annum since 1969 as against a total installed capacity of 30,600 tonnes per annum. The annual production of liquid glucose, on the other hand, was 23,000 tonnes against the annual capacity of 80,000 tonnes.

As a result of both the factors discussed above, the capacity utilization in the starch industry has remained around 50% of the annual installed capacity. The situation has further worsened as the government has issued additional licences for further expansion in the industry.

The demand for starch can pick up further and there can be considerable scope for development of the starch industry provided adequate and regular supply of raw materials is ensured.

Exports of Starch

Exports of starch from India have remained at a very low level so far. The reasons for this are inadequate supply of raw materials and unremunerative export prices of the finished products. If these two hurdles are overcome, there is no reason why our starch cannot be acceptable to overseas customers.

Conclusion

1. The performance of starch industry in India atleast in the organised sector - is not very encouraging in recent years. Inadequate and erratic supply of maize pose the major problem on the supply side. Escalation of maize price has resulted in higher costs of starch and starch products, thus inviting a certain amount of consumers' resistance.
2. On the demand scene, the growth and development of the major end-use industries is tardy in recent years which has put an upper limit on the growth of demand for starch.
3. The textile industry, the major consumer, does not appear to offer scope for substantial increase in demand for starch. In the long run, happily there is likely to be a significant growth in dextrose and glucose industries and hence the demand for starch generated in this sector is expected to rise over a period of time in tune with the pattern in the developed countries.
4. The export of starch should be stepped up as the export market in the South East Asia Region, the Middle East and the Gulf are very encouraging.

A sustained effort on the export front in the short run and growth of the major end-use industries will help the industry gain momentum to grow and operate at full capacity. (CV)

Current Technical Literature

Copies of articles/documents listed in this section are available on payment of Rs.5/- for the first 5 pages or part thereof and Rs.1/- for every subsequent page of the photocopy or xerox copy of the article/document. While placing the order, please mention the CTL number of the SENDOC Bulletin.

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CURRENT TECHNICAL LITERATURE

SCIENCE AND TECHNOLOGY

593. AWASTHI SK et al: Some thoughts on rural development with special reference to Uttar Pradesh. Chemical Age of India, 1980, 31(4), 357-362.
594. BHANEJA, BALWANT P. Parliamentary influence on science policy in India, Minerva, 1979, 17(1), 70-97.
595. DURGAPAL BC et al: Technological transfer for rural development. Indian Chemical Manufacturer, 1980, 18(5), 27-30.

An attempt has been made to discuss the impact of technology on rural development which could be helpful in evolving proper techniques of rural management.

596. KUMAR AV and SRINIVASAN D: Scope for the chemical engineer's involvement in rural development activities. Chemical Age of India, 1980, 31(4), 363-368.
- Discusses the characteristics of rural development programmes, alternative sources of energy which include gohar gas plants, waste plastics, garbage and litter, and bagasse. Highlights the new areas of industrial growth and industries using agricultural waste materials.
597. KUMAR P K: Science, technology and social conscience in the eighties. Bombay Market, 1980, 43(16), 79-82.
- Discusses the role of science and technology to strengthen the resources of developing countries. (MS)
598. TILAK B D: Rural Development through science and technology. Chemical Age of India, 1980, 31(4), 351-356.
- Highlights the initiatives regarding rural development through science and technology and enumerates the activities of the NCL Rural Development Centre. Suggests a scheme for rural development through science and technology. (BS)

AGRO INDUSTRIES

599. ----: Industrial profile - Cashew nut shell liquid. Industrial News Digest, 1979, 2(9), 3-4.
- Cashew nut shell liquid (CNSL), and its derivatives find use in brake-lining, paints and varnishes, and core oil (as a replacement of linseed oil) in foundaries. In addition, CNSL is a starting raw material for cardanol and its resins which are used extensively in laminations and surface coating and also for making paints. Brief details of processing, production, consumption, exports and imports are given.

600. BIRD, D: Animal feed industry in developing countries. *Milling Feed and Fertiliser*, 1979, 162(6), 30, 31 and 34.

Reviews India's feeds industry giving statistics of production and consumption. (BS)

601. CLARK S P et al: Pilot plant production of sunflower seed flour. *Journal of the American Oil Chemists' Society*, 1980, 57(3), 275A-279A.

Describes the pilot plant production of flour from hull-tree prepressed kernels from confectionery type sunflower seed. Discusses the various aspects of production with the help of tables showing important observations. (CV)

602. GOODIER B G et al: Sunflower oil - an emergency farm fuel. *Agricultural Engineering*, 1980, 61(3), 20-21.

Highlights the commercial benefits of sunflower oil as farm energy. (SS)

603. KRISHNA, GOPAL: Quality control parameters in compounded feed analysis. *Dairy Guide*, 1980, 2(9), 9-14.

604. VIMAL O P & NAPHADE K T: Utilisation of non-edible oil-seeds - recent trends. *Journal of Scientific & Industrial Research*, 1980, 39(4), 197-211.

Presents an integrated view of the multi-functional aspects of non-edible oilseeds so as to promote their maximum utilisation.

FOOD AND ALLIED INDUSTRIES

605. ----: Modern ingredients make icing a flourishing art. *Bakers' Review*, 1979, (July), 8-9, 11, 13.

Highlights different decoration practices with royal icing in confectionery. (MKSS).

606. ----: Packaging processed foods. *Package Engineering*, 1980, 25(2), 31-35.

Gives a state of the art report on packaging of processed foods.

607. BHATTACHARYA D C et al: A modified method for the preparation of Bhapa Dahi. *Indian Journal of Dairy Science*, 1980, 33(1), 38-42.

Flow diagram for the preparation of 10 kg. Bhapa dahi is presented. (MKSS).

608. KRISHNAMURTHY G V: New products from cashew apple. AFST Hyderabad Chapter's Chronicle, 1979, 3(3&4), 8-10.
Highlights the importance and potential of cashew apple and detailed preparation of products such as juice, syrup, cashola, jam, candy, canning of cashew apple, curried vegetable, fruit, chutney and pickel. (MKSS).
609. LEWIS Y S AND KRISHNA MURTHY N: Processes for production of green pepper and buff-coloured white pepper. Inventic Intelligence, 1980, 15(3), 121-123.
Process details for dehydrated green pepper and buff-coloured white pepper, developed by CFTRI, Mysore are given. (JBS)
610. O'DELL J: Modified starches, International Flavours and Food Additives, 1979, 10(1), 26-29.
The process used to modify starches is explained and an account is given of the wide range of uses of modified starches in processed foods. (MKSS)
611. PASRICHA S: Refreshing beverages. Food and Beverages, 1980, 2(9), 26-27.
Recipe and process are given to prepare orange, sweet lime juice, lime squash, mango juice, mango phool, grape crush, syrup etc. on home level. (MKSS)
612. VERMA R D & SARMA S C: Design of cold storage, Indian Dairyman, 1980, 32(7), 535-541.
Discusses economic feasibility, building requirement and thermal insulation, transmission load, and equipment selection with design diagram (MKSS).
613. WERNEL L: Encapsulated food acids. Cereal Foods World, 1980, 25(3), 102-103.
Food acidulants are used in almost all food products for flavouring and textural effects. Explains their uses, shortcomings and future applications. (MKSS)

CHEMICAL INDUSTRIES

614. AABIDA Seminar on alcohol based industries in the eighties. Indian Chemical Journal, 1980, 14(10), 37-42.
Reviews the status of the alcohol based industries giving perspective production plan and comparative costs of products based on alcohol and petroleum. (BS)

615. KAVADIA P N: The scope for development of alcohol-based chemicals in South India. Chemical Weekly, 1980, 25(31), 57-64.

Reviews the production trends of sugar and alcohol upto 1977-78. Gives comparative statements of sugar and alcohol for All India and South. Examines the future production scope of sugar, molasses and alcohol and estimated requirements of alcohol by 1981-82. Lists out the approvals given for alcohol based industries in 1977-78. (BS)

616. KHARBANDA O P: Sodium hydrosulphite. Chemical Weekly, 1979, 24(34), 290-293.

Typical process and material requirements for the manufacture of sodium hydrosulphite are outlined. Future and technoeconomic data are indicated. (MSR)

617. KHARBANDA O P: Sodium hydroxide (caustic soda). Chemical Weekly, 1979, 24(34), 282-289.

Electrolytic process of manufacturing sodium hydroxide has been indicated. Material requirements, manufacturers, future and technoeconomic data have been given. (MSR)

618. MAZUMDAR A H: Maintenance management in chemical industry (Part III). Chemical Industry News, 1979, 23(10), 769-774.

Discusses the aspects of effective implementation of the maintenance budget, highlights the role of financial and accounting department and finally presents the results of the survey conducted on the same.

619. MAZUMDAR A H: Maintenance management in chemical industry (Part-IV). Chemical Industry News, 1979, 25(3), 98-103.

Discusses the aspects of inventory control and standardisation in spare parts management and presents the results of the survey on both of the above aspects. (BS)

620. NANDI N R et al: Design concept for caustic-chlorine plant for a developing economy. Chemical Age of India, 1980, 31(5), 633-638.

621. OTHMER D F: Alcohols as fuels and chemical feedstocks. Chemical Manufacturer, 1980, 18(3), 21-25.

Enumerates the innumerable uses and applications of silicones such as water repellants, antifoam, polishes, adhesives and sealants, surface treatments etc. Also outlines the outstanding characteristics of silicones. (CV)

622. SOMAN S S: Application of silicones. Indian Chemical Manufacturer, 1980, 18(3), 21-25.

Enumerates the innumerable uses and applications of silicones such as water repellants, antifoam, polishes, adhesives and sealants, surface treatments etc. Also outlines the outstanding characteristics of silicones. (CV)

SOAPS AND DETERGENTS

623. ----: Industry profile: Soap Industry (II). Industrial News Digest, 1979, 2(11), 3-6.

Important aspects such as production, consumption and demand, R&D work, employment, exports and imports are considered. (JBS)

624. GODBOLE V N & PARANJAPE A V: Role of sodium tripolyphosphate (STPP) in detergents (with special reference to small scale industries). Chemicals and Petrochemical Journal, 1979, 10(6), 10-12.

625. JUNGGERMANN E: Soap and fat-based detergents. Journal of the American Oil Chemists Society, 1979, 56(11), 827A - 830A.

Presents the state of the art of soap technology and the most important classes of fat based surfactants. (KSDR).

626. KRISHNAN K S: Potential for manufacture of detergents in small scale. Chemicals & Petrochemicals Journal, 1979, 19(6). 16-18.

627. RAGHUVIR K & CHITRE M K: Problems of small scale laundry soap industry. Chemical Weekly, 1979, 24(22), 82-83.

Problems of soap industry with regard to raw material availability, excise duty, and power are highlighted. (MSR)

PESTICIDES

628. ----: Industry profile: Pesticides industry. Industrial News Digest, 1980, 3(6), 3-7.

Tabulates production and consumption of basic pesticides, the import and export for the recent years, and the R&D work taken up by different laboratories.

629. ----: Pesticides industry in India - Problems and prospects. Industrial Researcher, 1980, 6(4), 269-279.

Details of production of important varieties of pesticides, imports and exports, demand estimates, production capacities (licensed/installed) of various manufacturers and production requirements by 1982-83 are given. (JBS)

SURFACE COATINGS

630. BHAVSAR V H & DESAI C R: Glycerine in surface coatings: Part II: Glycerine versus pentaerythritol. Journal of the Colour Society, 1980, 19(1), 17-24.
631. KHANOLKAR P S: Paint drying processes - 'Stoving Ovens'. Paintindia, 1979, 29(11), 26-32.
- Discusses the methods of drying paint film by stoving process. (KSDR)
632. MANI T K S: Scope for development of paint industry in South India. Paintindia, 1980, 30(3), 6-9.
633. MORRIS A G: A tank cleaning system for the small paint plant. Journal of Coatings Technology, 1979, 51(656), 81-84.
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- Red oxide pigment (persian Gulf grade) is being imported from foreign countries. The object of this study is to improve the Indian red oxide colour to that of imported grade red oxide by suitable treatment. The results of this investigation are reported.

PLASTICS

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- Describes the basic types of blow moulding viz., injection coextrusion stretch blow moulding and their design considerations. Illustrates the vacuum forming principles and techniques and finally throws light on recent manufacturing trends. (SS)
636. ----: New polyethylenes promise tougher and cleaner films. Package Engineering, 1980, 25(2), 48-49.
- Discusses the characteristics of the new range of resins which are hybrids of LDPE and HDPE, retaining properties from both. (BS)

637. CAMPBELL MI: Reinforced plastics bearings (Technical file No.73). Engineering 1980, 220(1), I-VIII.
638. JAIN R K: Polymer concrete review, Popular Plastics & Rubber, 1980, 25(5), 3-7.
Reviews different types of polymer concrete and their applications.
639. MATHER J N: Welding plastics, Engineering Materials and Design, 1979, 23(5), 45-48.
Plastics welding techniques can be used with components of sub-assemblies which have been injection, compression, rotationally moulded extruded or blown. The methods used in conjunction with these materials are hot-plate welding, ultrasonic welding, spin welding, and angular or linear movement friction welding. These methods are discussed. (SS)
640. MODY S R: Applications of Nylon-6 moulding powder. Vishwakarma, 1979, 20(7), 11-16.
Highlights the growth of Nylon-6 industry in India, gives the list of possible applications, and indicates the engineering properties of Nylon as compared with metal. (KSDR)
641. RAICHE A: Factors to consider when selecting a clear thermoplastic. Plastics Design and Processing, 1980, 20(2), 28-32.
642. SANKAR N: Scope for development of plastics industry in South India. Chemicals and Petro-chemicals Journal, 1980, 11(2), 33-41.
Gives the production of plastics raw materials during 1960-1978, exports of plastic products during 1973-79, consumption pattern of plastics raw materials during 1972, 1975 and 1978, demand for plastic raw material manufacturers in southern region, consumption of major plastics in southern region and the export of plastic products from the southern region from 1972-73 (KSDR).

LEATHER INDUSTRY

643. CHOUDHURY G R: Export promotional and commercial aspects of footwear and leather goods industry. Leather Processing, 1980, 3(7), 20-22.
Reviews the export performance of leather and leather goods industry discussing the aspects of customs clearance floor price, quality control and preshipment inspection, certificate of origin, export finance, arbitration and excise duty and gives statistics of exports for the year 1976, 1977, 1978, 1979 and targets for 1980 and 1981. (BS)

644. JAH M N: Footwear and leather goods industry problems and prospects. Indian Footwear, 1980, 4(4), 35-36.
645. JEFFERY D: Quality..It won't control itself-1. Indian Footwear, 1980, 4(4), 11-12.
Highlights the functions in a footwear factory that have no direct link with quality control but nonetheless have an important part to play in keeping up quality standards. (BS)
646. KEECH B: Quality-it won't control itself-2. Indian Footwear, 1980, 4(4), 13-16.
Discusses the quality control aspects of wet leather footwear, specialist footwear, heavy duty footwear and indoor footwear. (BS)
647. PATHUSHA K M: Importance of leather industry in Tamil Nadu. Leathers, 1980, 21(2&3), 15-17.
Reviews the leather tannery network in Tamilnadu and examines the scope for further development. (BS)
648. RAHMAN P K: Problems of small tanners and exporters. Leather Markets, 1980, 9(6), 17-21.
649. SANKAR S: Simple test methods and specifications of components used in stuck-on-shoes. Indian Footwear, 1980, 4(4), 26-29.
650. SELVARANGAN R: Indian Leather Industry by 2000. Leathers, 1979, 20(4), 25-29.
Examines the future scope of hides and skins, leather chemicals and machinery, rural leather and leather based industries and mechanised leather and leather based industries. (BS)
651. SHAH H C: Studies on basic chromium sulphate and chrome-tannage; Part-I, Usage in tanneries, Indian Leather, 1980, 14(6), 25-33.
Discusses the operations involved in chrome tanning process and gives a flow sheet with typical production data to indicate the approximate normal commercial limits for the salient variable which controls the operations. (BS)
652. Tancous J: Quick tests for 'trouble shooting' in the tannery. Leather Markets, 1979, 8(12), 7-13.

MECHANICAL ENGINEERING

653. ----: Bicycle chain wheel & crank. Kerala industry, 1980, 27(10), 34, 36.

Gives the Indian standards available, raw material and utilities requirements and economics for manufacturing bicycle chain wheel and crank (BS).

654. ----: Belt grinding can put milling in the shade. Machinery and production Engineering, 1980, 136(3499), 53-55.

Describes how an abrasive belt grinding can remove metal upto 10 times faster than a face miller (KLR).

655. GAINSBURY P E: Jewellery investment casting machines. Foundry Trade Journal, 1980, 148(3184), 457, 461-469.

Investment casting is by far the most widely used technique for the production of gold jewellery. Each year, large quantities of carat gold alloys are processed by this method. It is therefore of importance that machines used for jewellery investment casting should meet the efficiency and quality standards expected in large scale manufacturing equipment. The casting processes and machines used in the manufacture of jewellery are described.

656. GOODHAND T: Programmed maintenance. Forge, 1980(87), 10-13.

Advanced planning and a common sense approach to scheduling helps the plant engineer achieve a successful maintenance programme during shutdown. The various methods of scheduling, controlling and planning of shut-down maintenance of plant and machines in forge industry are explained.

657. KELLOCK B: Gear-making years of steady progress. Machine and Production Engineering, 1980, 136(34.99), 34-36.

Describes the improvements in gear-making and how the new machines introduced offer better performance. (KLR)

658. MAHAJAN J M et al: Production control for continuous manufacturing system. Industrial Engineering Journal, 1980, 9(4), 25-28.

Outlines the importance and main purpose of production control in continuous manufacturing and discusses various information forms developed for continuous system. (SS)

659. MINCHIN R S: How to cut bevel gears on a miller. Machinery and Production Engineering, 1980, 136(3499), 41-43.
660. MORGAN H L: Recent developments in electric melting and holding furnaces. Foundry Trade Journal, 1980, 148 (3183), 7-8; 11-16, 19-25, 28-36, 40, 43.
Reviews the present day use of electric melting and holding furnaces in the non-foundry industry and compares the various types of furnaces which are in common use. (SS)
661. MOXON J C: 10 ways not to treat chains and sprockets. Engineering, 1980, 220(2), 173-175.
Describes the sort of treatment that can cause chains and sprockets to wear rapidly and suggests ways of avoiding these pitfalls.
662. WINSHIP J T: How metal containers are made. American Machinist, 1980, 124(4), 155-161.

ELECTRONICS INDUSTRIES

663. SHARMA A S: The cassette tape. Electronics Today, 1979, 2(9), 15-18.
Explains the three major parts of cassette tape namely the basic film, the coating and the cassette housing. The advantage of polyester film over cellulose acetate film are given. The mechanical performance, magnetic conversion, specifications, physical properties, magnetic properties, recording properties etc. are given in tabular form. (VVR)
664. SONI D K: Soldering techniques (Part-2). Electronics For You, 1979, 11(5), 47-50.
Explains various types of soldering techniques namely handsoldering, dip soldering, wave soldering, induction soldering, resistance soldering, ultrasonic soldering etc. Gives details of soldering semiconductor components and some common soldering defects with main reasons and explanations. (VVR)
665. SWAIN G: Passive components-resistors and pots. Electronics Australia 1980, 41(10), 72, 73, 75 & 76.
Describes one of the most important electronic building blocks namely the resistor, a simple device which is used to establish voltage and current levels throughout a circuit (VVR)

666. WALTON A: Switches and relays-a materials viewpoint. Electronics Industry, 1980, 6(1), 40, 41, 43, 45, 47.

Outlines how mechanical switches, reed switches and relays, and solid state and mechanical relays are limited by the materials used in their construction. (VVR)

667. YATES W: Chip components. Electronics Product Magazine, 1980, 22(8), 47-53.

Explains the performance, physical characteristics and selection of chip capacitors, resistors, inductors and transformers which are used in applications ranging from tele-communications to medical electronics. (VVR)

SENDOC Services

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2.	Ent.Bihar	Profiles on: Industrial alcohol
3.	Ent.Delhi	Profiles on: Plastic products, Pharmaceuticals
4.	Ent.Gujarat	Profiles on: Ice plant, Fruits and Vegetables preservation and canning
5.	Ent.Karnataka	Profiles on: Dry distemper, Sodium sulphate
6.	Ent.Madhya Pradesh	Profiles on: Acrylic sheets, Guar gum
7.	Ent.Maharashtra	Profiles on: Rubber rollers for rice mill, AAC and ACSR Conductors, Roller flour mill, Crown corks, Candles, Polythelene films and bags, Ice plant, Fruits and vegetables preservation and canning, Oxalic acid, Phenyle, Cement plant, Dry distemper, Tarpaulin.
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0.	Ent.Uttar Pradesh	Profile on: Adhesives for plywood
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- | | |
|-----------------------|--|
| 13. SI.Assam | Profile on: Furfural |
| 4. SI.Gujarat | Profiles on: GLS lamps, Tarpaulin,
Mini Cement plant |
| 15. SI.Karnataka | Profile on: Tartaric acid |
| 16. SI.Madhya Pradesh | Profiles on: Aluminium sheets, circles
and utensils, Aluminium hardwares,
Aluminium furniture, Potato starch |
| 17. SI.Maharashtra | Profiles on: Paper cones, Wooden
bobbins, Straw board, Plastic tubes,
Ice plant, Handmade paper, Maize
starch, Brass utensils, Tamarind
products, Pectin |
| 18. SI.Orissa | Profile on: Cement plant |
| 19. SI.Uttar Pradesh | Profiles on: Bleaching powder,
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